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JULY — DECEMBER, 1887.

ILLUSTRATIONS.

[*The figures refer to the number of the journal, and not to the page.*]

ECCLESIASTICAL.

EDUCATIONAL.

FOREIGN.

GELATINE.

HOTELS.

INTERIORS.

LIGHT-HOUSES.

MERCANTILE.

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THE AMERICAN ARCHITECT AND BUILDING NEWS.

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CONTENTS

WE are accustomed to finding attacks on architects in the insurance journals, and, knowing the tendency of human nature to blame others for the misfortunes brought about by one's own folly, have generally been disposed to overlook them, but we are sorry to find that *Fire and Water*, the honest and able representative of the fire-engineers' views of such subjects, has unthinkingly fallen into a similar way of talking. In a recent article on "Fire Hazard and Architecture," the editor, after deploring the universal use of wood finish in place of more resisting materials, says that "owners generally want a little money to go a good way and are willing to sacrifice strength for show, and architects and builders are very willing to gratify them in this respect," and concludes by putting "most of the blame for the combustibility of our structures on the builders and architects, who, as it says, "make building a study and should know better." This proposition has a specious sound which is very likely to deceive the ordinary writer, as it seems to have done the author of it, and it ought to be controverted without delay. We will leave the builders to fight their own battles, but in behalf of the architects, who, as we are informed, "ought to know better" than to design six-story buildings with wooden roofs, we should like to inquire if there is any respectable architect in the country who does not know that such buildings are bad fire-risks, or who is not perfectly acquainted with the methods of increasing their resistance to conflagration to any extent? After thus holding up the architects to reprobation, *Fire and Water* proceeds to assert that "Fireproof construction is the best in the long run, on the score of economy both to the owners and the public." This maxim may do for firemen, but architects and owners cannot dispose in such an easy way of the problems presented to them. We venture to say, for example, that if the editor of *Fire and Water* wished to improve a lot on a village street, he would, however excellent his principles, regard an architect who told him that the best and most prudent way of doing so would be to build a fireproof structure in the middle of it as little short of a lunatic. And he would be right, for a heavy, expensive structure which could not be rented for a fair interest on its cost, and could not be removed without great loss when circumstances made it advisable to utilize the land in a different way, would be a most foolish investment, and owners, with reason, expect architects to think quite as much of planning buildings which will bring in a good return on the capital locked up in them as of making them satisfactory to the underwriters. With this consideration in view, there are few architects who do not try to contrive even their cheapest buildings so as to resist fire as well as can be done without sacrificing other interests of greater importance to the owner. Whether rightly or wrongly, many real-estate proprietors have an idea that underwriters charge them a high price for insuring them against ord'nary fire-risks, and then, for their own profit, try to take advantage of any improvement or alteration on the estate to work upon the feelings of the architect, so as to get him surreptitiously, at the owner's expense, to convert, for the benefit of the underwriters, the bad risk, which they are paid for insuring, into a good risk without change of rates. It is true that architects are usually willing to incur something of their share of this suspicion for the sake of advocating what they think to be good principles of building, but it is too much to expect them to throw overboard every other consideration of prudence and economy for the sake of promoting the interest of the underwriters, who might, with advantage, recall occasionally the fact that all the important improvements in the art of fire-resisting construction have been devised either by architects or the officers of the mill mutual insurance companies; that in the practice of this art the architects of America stand at the head of the whole world, and that the rules and regulations which are now feebly put forward by underwriters' associations in our larger cities have never yet, so far as we have seen, contained a single suggestion or warning that had not been familiar to all respectable architects for many years, while a good part of the rules which have come under our observation are mangled and absurdly misunderstood imitations of maxims drawn up for various occasions by architects and builders.

THERE is in England just now a certain movement against the South Kensington system, as it is called, of teaching art, which has called forth much talk on both sides. Whether good or bad, the system has, through the affiliated schools all over the kingdom, taught by graduates of the parent institution, and supplied with examples from the unrivalled Kensington collections, an immense influence, and South-Kensingtonism, to call by its common name a familiarity with forms of art, is perhaps one of the most striking features of English life at the present day. No doubt the teaching of the school, under some instructors, has fallen into the dry archæological drill, so fatal to artistic fancy, which the English are naturally rather inclined to substitute for the more difficult education of the imagination, and the sarcasms about the wooden-looking designs "in the Græco-Italian style," or the "plaques ornamented with Hispano-Moresque patterns in relief," which one often hears when the school is spoken of, are not without foundation; but it is certain that the best of the work done at the schools of art under the direction of the South Kensington authorities is often exquisitely beautiful, while the systematic and uniform dissemination of the simplest principles of taste, and, still more, of good models, has done wonders for the artistic education of the English people. Whether it is not time now for something better is, however, a fair question, and not long ago a violent attack was made on the whole system by a Mr. Partington, who was in turn effectively answered by Mr. Pearson, the head of the admirable school of art in Manchester. Not content with his own presentation of his case, Mr. Pearson asked for the opinion on the subject of some of the most noted artists in England, among others of Sir John Everett Millais, Mr. Ruskin and Mr. Wilalim Morris.

SIR JOHN MILLAIS, one of the greatest of modern painters, who has won his place by conscientious work, replied to Mr. Pearson's note by remarking that the complaints of an art-student about the irksomeness of the drill which he had to go through always seemed to him to resemble the lamentations of a bad workman over the faults of his tools. After the preliminary training of the hand and eye, the best teaching in art was to be obtained from the study of fine examples, which South Kensington provided for its pupils with a generosity unknown to the students of past generations, and he advised persons who wished to learn art not to trouble themselves about the merits or demerits of the official systems, but to be thankful for the advantages offered them, and to work "steadily and humbly" through the preliminary drill, however tiresome it might be. As to the influence of the system in developing great artists, he thought no discussion was necessary. Great artists were not produced from ordinary material by any process of education. They might be somewhat hindered or advanced by bad or good training, but beyond the first steps

they must depend upon themselves, working out their progress by their own efforts and judgment.

AN appeal to Mr. Ruskin on matters of art always presents the sort of interest which attaches to the process of stirring up a bear with a long pole, and Mr. Pearson seems to have evoked a characteristic growl. "If the twenty-six students," said the great critic, "on whose behalf you sign will subscribe each of them a shilling fee for my opinion, let them buy my '*Laws of Fesolé*,' and lend the book to each other and do what it bids until they begin to understand a little what it means." As a person could hardly do what a book bade him without understanding what it meant, we infer that lending Mr. Ruskin's writings about tends to the elucidation of their contents, and regret that we have not been able to lend more extensively the concluding portion of Mr. Ruskin's epistle, in which he observed that, notwithstanding the assistance to be derived from circulating the "*Laws of Fesolé*," it would be impossible "for Manchester, or any towns the least like Manchester, to have schools of art in them at all." The reason of this singular discrimination of the Muses against Manchester and similar towns was, as he informed Mr. Pearson from "very sure and stern knowledge," that "art could not be taught by fouling the skies over their heads and stealing their drink from other lands." We cannot imagine that Mr. Pearson steals his drink or fouls the sky, and have therefore concluded that this must be a figurative expression, intended to imply that students cannot draw or paint so well in a hazy atmosphere like that of Manchester, and that the disorders caused by drinking water from the town pump are more favorable to artistic inspiration than the peace of the digestive organs which is promoted by the use of a purer beverage; but beyond this translation of Mr. Ruskin's rhetoric into plain English our intuition has not been able to carry us, and we leave the task for persons of more penetration.

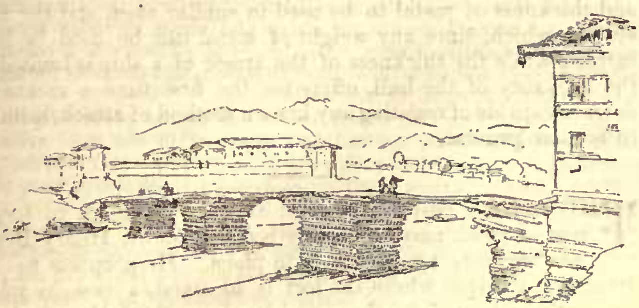
MR. MORRIS'S reply, like everything that he writes, was clear and practical, and, moreover, strikingly similar in ideas to that of Sir John Millais. "No system," said he, "could teach a man to be an original designer," but a man who had the capacity in him might have his labor of learning shortened by availing himself of the experience of ages. In his opinion, the proper business of the public schools of art was not to try to create professional designers, but to teach people to draw correctly and to color tolerably well, and to understand something of the history of the arts, so as to appreciate what they saw about them. Such training as this would, he thought, be useful and pleasant for every one to possess, and would, by the cultivation of taste, promote that widespread feeling for art which must exist before great artists can be produced. To attempt more than this in such schools and to substitute the teaching of style for the training of eye and hand, he thought to be injurious both to the student and the public, and "sure to end in failure of one kind or another."

THE future course of the art of fortification seems to lie in the direction of providing impervious boxes, just large enough to contain one or two guns, at the commanding points of a given coast, using each of these, like the keeps of the mediæval castles, as the nucleus of a group of earthworks. A stronghold planned in this way would fulfil pretty well the Irishman's idea of a perfect fortification, in which, if an attacking party got over the ramparts it would find itself on the same side that it started from; for, if hard pressed, the defenders of a line of earthworks could take refuge in the impregnable turret, while the capture of the exterior line would only expose the captors to annihilation from the turret within. Already several turret citadels have been constructed, and we remember seeing some curious objects at the entrance to a harbor in North Holland, much resembling a pair of very large turtles, which proved to be two of the strongest forts in Europe. These fortresses, like the others of the sort which have been constructed, were simply flat domes of iron, revolving on a circular foundation, and having two or three port-holes in each, closed by a shutter when not in use, and serving for an equal number of enormously heavy guns. The domes were thick enough to be practically impenetrable, while the projectiles fired from them at a vessel entering the harbor which they guarded would pierce the heaviest armor yet put on a ship. Since the building of these forts at the Helder, many trials have been made to determine the best kind and thickness of metal to be used in similar ones, and the new system, which, since any weight of metal can be used in land turrets, while the thickness of the armor of a ship is limited by the buoyancy of the hull, offers for the first time a means of defence capable of resisting any known method of attack, is likely to become general.

THE immense cost of a fort of this kind, if made of forged iron or steel, may be greatly reduced, as Sir Henry Bessemer suggests, by casting it in place. He proposes to construct, on the spot where the fort is to stand, a core, by piling up earth and sand in the requisite form; and then to build around it a brick wall, held together by iron bands, and carrying the moulds for the exterior. Around the wall are to be placed the melting furnaces, arranged for charges of twenty tons, and each capable of melting eighteen charges a day. With four such furnaces a ton of melted steel per minute could be poured into the mould, and a dome weighing a thousand tons cast in less than a day. As the mass would need no transportation, it might be made much heavier even than this, and, upon cooling, would require nothing more than the removal of the core, which would allow it to settle down upon the cannon-balls intended to serve as wheels. The port-holes would be cast in the mass, and would, of course, need little or no finishing, and the cost of a thousand tons of steel, with Bessemer ingots at half-a-cent a pound, would be a mere trifle, compared with that of forged plates, riveted together.

THE announcement is made that the Post-Office Department has established a parcel-post service between the United States and Mexico, and certain islands in the West Indies, by which packages weighing not more than four pounds and a fraction, by which we suppose is meant two kilogrammes, can be sent through the mails, and delivered to the person addressed, upon payment of the customs dues. We are glad that so much has been accomplished, and hope that the extraordinary facilities enjoyed by those persons who have business with Mexico will call the attention of their neighbors, whose business relations are with other countries, to the inconveniences under which their transactions are carried on, as compared with the postal facilities enjoyed by the inhabitants of all other civilized countries. The absence of a parcel-post service, both inland and foreign, is a disgrace to the Government of the United States. The Postmaster General seems, from his annual report, to have made a small effort to give his fellow-citizens such use of the mails as is enjoyed by people abroad, but, as he naïvely says, the express companies opposed the idea so strongly that he was obliged to abandon it. It is not unnatural that the express companies should oppose a plan for transporting packages by the mails at a small fraction of the rates which they demand for the same service; but there is something to be considered in the administration of a public office besides the interest of the express companies; and their opposition ought not to be regarded for a moment in comparison with the great benefits which would be conferred upon the people of the United States by such a postal service as, for instance, that of Germany. The greatest need of this country is, and will be for many years, cheap transportation. For want of this the California farmers are compelled every year to feed their pigs with hundreds of thousands of dollars' worth of fruit worthy of the Gardens of the Hesperides, while the poor working people of Chicago and New York, to whom a Los Angeles plum, or a Florida pineapple, would be a taste of Paradise, must go without everything except the great staple articles, on account of the enormous cost of getting it. In Germany, supposing it to be provided with such a varied climate as ours, the fruit-grower would distribute broadcast in the cities return postal-cards, containing blank orders for four, five or six pound boxes of apricots, grapes, fresh figs or oranges, which, on receipt of the slip, with money-order, would be delivered by the next mail at the house of the consumer. Tons of fresh herrings, butter, and other articles are distributed daily in this way all over Germany, to the advantage of the fishermen and farmers, who find a sure market for the product of their toil, as well as of the citizen, who finds his tastes satisfied at a small cost, and of the public treasury, which can transport such articles profitably at a small fraction of express charges.

UNITED STATES GOVERNMENT BUILDING PRACTICE.[1] — V.



Native Bridge on the Sutlej. Hindustan.
after sketch by Wm Simpson

THE walls of buildings are generally built of stone and brick: temporary buildings only, such as wards for marine-hospitals, quarantine-sheds for cattle, etc., are built of wood.

In stone buildings, usually, the facing only of exterior walls is stone, the ashlar varying in depth from 6″ and 10″ to 12″ and 16″ in alternate courses: the backing of exterior walls and all interior walls are built of brick: interior piers are usually built of brick, with bond-stones, except in cases where great strength is required when they are built of dressed and coursed stonework.

The stone and brick work of a building is always put under contract, after advertisement and competitive bids have been received. For small buildings the stone and brick work is usually let in one contract, for furnishing all materials and putting the masonry in place complete: this is always done when the facing of the body of the walls is brick and the trimmings, belt-courses, cornices, etc., are stone. For larger buildings costing in the aggregate $100,000 or more, where all the exposed facing of walls is of stone, it has been the practice of late years to make one contract for furnishing and setting the stone complete, and a separate contract for the brickwork.

The stone, which was Buena Vista sandstone for the Chicago Custom House and granite for the New York Post-Office, Boston Sub-Treasury and Post-Office and Cincinnati, Hartford, Philadelphia and St. Louis Custom-Houses, was purchased, after advertisement, by the cubic foot in the rough, allowing what was called "quarry measure;" the price included delivery at the site of the building; and the cutting was done under what was called the "fifteen per cent contracts." By "quarry measure" was meant the adding of one inch for granite and one-half inch for sandstone to the dimensions of the stone for each cut-face joint, bed and build; where brick backing came against a stone no allowance was made: this system would always make a stone, if granite, two inches higher, generally two inches longer and one inch wider than the net dimensions of the stone, and payment was made per cubic foot of quarry measure so determined. Quarry measure has been entirely abandoned and was only allowed on the buildings above mentioned: it was a source of almost endless dispute between the office and contractors. The basis of the fifteen per cent contracts was, that the contractor should use all due diligence in cutting the stone in a first-class manner, and that the Government should pay him for the actual cost of the cutting, and fifteen per cent of the actual cost in addition thereto, which was to be his profit, and as this was a fair, reasonable and assured profit it was presumed the contractor would have no object in slighting any portion of the work. Practically the work was of a finer grade and the cutting better executed than usual, but it cost about twice as much, and was unnecessarily prolonged.

With the exception of the five buildings before mentioned, and until the last few years, it was the practice to make a contract for furnishing and delivering the stone at the building cut ready for setting. The setting of the stone and the furnishing and laying the brick were put in a separate contract. It is now the practice to make a contract for furnishing, cutting and setting the stone in the building complete.

Ordinary carving, bas-relief work, etc., are included in the contract for stone; but the modelling and carving of statuary are contracted for separately.

Bidders are frequently required to submit a price per cubic foot for dimension stone in the rough, in case an extension of the building may be contemplated or additional stone required for any other cause.

The Government has used almost all the prominent building-stones in the United States: red and gray granites, marble, limestone, sandstone, and brownstone. Among the granites used may be mentioned: Hallowell, Fox Island, Dix Island, and Hurricane Island, Me., Cape Ann and Quincy, Mass., Concord, N. H., Richmond, Va., Woodstock, Md., Stone Mountain, Ga., Middlebrook, Mo., and Platte Cañon, Col., the last two red. Among the limestones: Oolitic, Bedford, Ind., Bowling Green, Ky., Juliet and Lamont, Ill., Onondaga, N. Y., and Fossick from Dickson, Ala. Among the sandstones: Amherst, Berea and Buena Vista, O., Warrensburgh, Mo., Stony Point, Mich., and Armijo, Col. Among the brownstones: Middlesex, Portland, Conn., Potomac, Seneca, Md., and Manassas, Va. Marble has only been used for walls in two buildings, namely: at Knoxville and Memphis, Tenn., from quarries near Knoxville.

All the granites mentioned are very fine building stones: the Virginia and Georgia granites are much lighter in color, finer grained, and more easily worked than the others. Large quantities of the Maine granites have been used, also a considerable amount of the Massachusetts and Virginia granites. Some very fine samples of granite have been received at the office from Waupaca, Wis., but none have been used yet: the color varies from light red to a dark blackish red and it receives a very beautiful polish.

The limestones, brownstones and sandstones are generally of very good qualities: large quantities of the Bedford and Illinois limestones and of the Amherst and Berea sandstones have been used.

The Buena Vista sandstone of Ohio has not proved as good a stone as the others; it is easily broken under a strain and scales and cracks badly under the action of the weather.

SPECIFICATION.

Generally. — The contractor to furnish all the labor and materials (stone, sand, cement, lime and water) and cut and set the stonework as required by the drawings and specification; make the sinkages for and build into the stone all the anchors, cramps, dowels, etc., that may be necessary.

Kind of Stone. — Steps, platforms, door-sills, area-copings, bond-stones, pier-caps, and bearing-stones for columns, girders and trusses will be of granite: a good hard limestone may be used for this purpose if granite is found to be too expensive. Foundations and facings of walls coming in contact with the earth are generally built of granite or limestone, as sandstone is not thought to stand the action of the earth, moisture, etc., as well as the former.

Each bidder is required to submit a sample (12″ x 6″ x 4″) of the stone he proposes to use, one face showing natural fracture and the others the different kinds of cutting, bed-work, face-work, etc., called for.

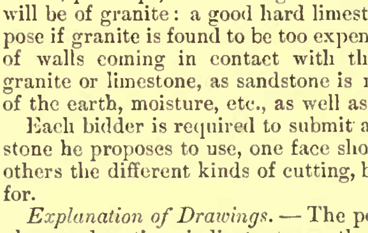
Explanation of Drawings. — The portions hatched in solid lines on plans and sections indicate stone: the portions hatched in alternate solid and broken lines indicate brick. All the dimension and cut stone is numbered and figured on the drawings and the stone must be cut to the exact sizes, profiles, etc., indicated. Full-size drawings of the moulded work and models of the carved work will be furnished the contractor.

Quality of Stone. — All the stone to be hard and durable, close-grained, of good texture, and free from defects and discolorations other than such as are allowable in first-class work, and to be of the dimensions and designs shown, noted and figured on the drawings: all the exposed stonework above ground-line to be of an even, uniform color.

Quarry. — The quarry from which the stone is proposed to be obtained must be fully opened and developed, and capable of supplying all the stone required within the time named by the bidder: the name and location of the quarry must be stated in the proposal.

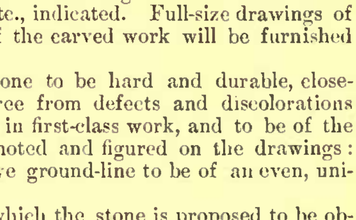
Unexposed Walls. — The unexposed walls of buildings and areas below ground-line may be random rubble, squared and coursed masonry, random ashlar, or rock-face coursed ashlar.

Random Rubble. — The random rubble-work to be built solidly through the wall in courses, each course brought to a level every 18″ or 20″ and to have headers of suitable size running through the wall, placed in position before the course is built, every six feet apart; the joints to be not over one-half inch wide.



Section Elevation
Fig. 4.

Coursed Masonry. — The coursed masonry to extend entirely through the wall: the courses may vary in height and the stones in lengths and widths but each course must be level throughout, and the stones must break joint and all the beds, builds and joints must be squared. No stones containing less than three cubic feet to be used, and each course must be bonded by through stones at least every eight feet: the faces of all unexposed stonework to be rough or rock-face and the joints and beds worked true, fair and out of wind, and not to exceed one-half inch thick.



Section Elevation
Fig. 5.

Squared Masonry. — The squared masonry to be built in the same manner as the coursed masonry, except that the stones are not to be in regular continuous courses and the through bond-stones will be required, one to every square yard of wall. The random ashlar and the rock-face coursed ashlar for unexposed walls to be built in same manner as for exposed walls, except that it is not necessary to have the projection uniform nor pitched off from line of joints.

Piers. — When piers are built of brick they must have cap-stones from 10″ to 12″ thick the full size of the pier, the top surface to be carefully levelled for the bed-plates of columns, girders, etc. to rest upon. Where bond and footing stones are required they must be in

[1] Continued from page 228, number 593.

one piece each, not less than five inches thick, the bond-stone to be the full size of the pier and the footing-stone must have sufficient projection beyond face of pier to give the necessary bearing surface.

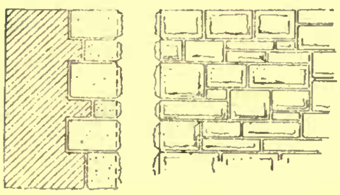
Where piers are built of stone, the stones must be of the heights and dimensions figured, each alternate course to be the full size of the pier and the footing and capstones to be in one piece each, not less than ten inches thick. The beds and joints to be not over one-quarter inch thick and to be of first-class bed-work: the exposed faces to be cut similar to the faces of bearing-stones.

Bearing-Stones.—All columns, girders and trusses to have bearing-stones from 10″ to 12″ thick and of sufficient size to distribute the weight so that not more than one hundred and fifty pounds load per square inch shall bear upon the brick-work.

The beds and builds of all cap, bond, footing and bearing stones to be perfectly level, true, fair, out of wind, and to have equal bearing throughout: the sides where coming against brickwork to be pitched off to the required sizes shown on the drawings, so as to form a close joint with the brickwork. The exposed faces to be axed, pean-hammered, or No. 6 cut-work if granite is used; and sawed, rubbed or tooled work if limestone is used.

Exposed Walls.—The exposed walls and superstructure may be faced with random ashlar, rock-face coursed ashlar or dressed ashlar; the water-table, sills, imposts, architraves, friezes, cornices, voussoirs, columns, pilasters, etc., to be finely dressed, cut to the dimensions, designs, profiles, and set in positions plumb and level, as shown on the drawings.

Random Ashlar.—Random ashlar may be used only for facing the basement walls below water-table, and dressed stone for the superstructure, or it may be used for facing the walls of superstructure, parapets, gables, dormers and chimneys; it is to be rock-faced, to have usually 8″ and 12″ beds, and built up solid with proper housings for bond with brick backing; not in regular courses, but having horizontal beds and vertical joints, as indicated by Figure 6; no stone of less than thirty-six square inches on the face to be used.



Section Elevation
Fig 6.

The beds and joints to be square with face of wall and the rock-facing to be uniform, pitched from, and not to project more than 1″ or 1½″ beyond line of joints, which must all be in the same plane. The angles of buildings and of openings where shown to have 1″ or 2″ wide drove or tooled margin if of limestone, marble, or sandstone, and Number 6 cut or Number 8 cut if of granite. The jambs and reveals of all openings to be dressed similarly to the cut stone of the building. Where quoins are shown at the angles of the buildings and at openings, they are to be dressed similarly to the other cut stone, and to have a bond of from 4″ to 8″ with the random ashlar: the face of quoins may be on the same plane with line of joints, or may have a projection equal to that of the rock-face work. No drill or tool marks to show on any exposed rock-facing.

Rock-face Coursed Ashlar.—This work may be in random heights and lengths, but each course must have the same continuous height throughout, or it may be in regular figured heights and lengths; in such cases it becomes dimension stone, the courses to alternate having beds usually 8″ and 12″ wide. There should be a difference of 4″ in the bed of each alternate course, so that a proper bond may be had with the brick backing.

The jambs, reveals, beds and joints to be dressed square, and the angles to have margins the same as in random ashlar; or, instead of pitching the face off from the joints, if dimension-stone be used, each stone may have a dressed margin all around next the joint.

Dressed Ashlar.—Dressed ashlar to be coursed and jointed, and of the dimensions shown, and the courses to bond with brick-backing the same as rock-faced coursed ashlar. The faces, returns, and reveals of openings to be dressed similarly to the other cut stone in the building. The returns of all coursed ashlar to be equal to the bed of the widest course, and never less than 8″. No joints to show on face of reveal unless the reveal exceeds 16″ in depth and then only in alternate courses, and all ashlar to be thoroughly bonded and to break joint throughout.

Cut Stone.—All stones whose exposed faces are dressed smooth are classed as cut stone, and may be divided into ashlar, moulded and carved work. Stones with straight, square faces, and with a plain straight chamfer only are classed as ashlar; all stones with moulded profiles and curved surfaces are classed as moulded work, and the carved work is the ornamentation on stone made either by incisions or by raising the figures in low relief above the general surface.

CUTTING.

Face Work.—All exposed plain surfaces and mouldings, if of sandstone, to be fine rubbed work; if of limestone or marble, may be rubbed, square-drove, tooled, or bush-hammered, with drove or tooled margins, the tooling to be eight bats to the inch to top of first-story cornice, and six bats to the inch above; if of granite, to be Number 8 cut-work to top of first-story cornice and Number 6 cut above. Where moulded work cannot be easily tooled it is to be finely-rubbed work. The faces of all steps, platforms, and door-sills, which are usually granite, to be No. 6 cut-work properly weathered

Moulded Work.—All the moulded work to be of the dimensions, designs, and profiles shown, cut sharp and clean, in strict accordance with the full-size details. The shafts of pilasters and columns to have flutings and entasies worked as shown, and the beds for same to be worked fine, equal to face-work.

Carving.—All carving shown to be cut to the proper depth of relief, to be fine, bold, spirited, and executed in the most artistic manner in strict accordance with the full-size details and models.

The angles and arrises of all cut-stone work to be sharp, true, and clean.

Beds and Joints.—The beds, builds, and joints of all stonework to be fair, true, out of wind, and have an equal bearing throughout, and to be so worked that when stones are set the joints will not exceed ⅛″ thick for granite and marble, and from 3/16″ to 5/16″ for sandstone and limestone.

Backs of Stones.—The backs of ashlar, belt-courses, cornices, voussoirs, etc., to be roughly pointed or pitched off to the depths noted on the drawings, so that proper bond may be had with the brick backing. The underside and backs of steps and platforms to be rough pointed where not exposed. The backs of sills, jambs, mullions, transoms, and lintels of door and window openings to be good bed-work, square, plumb, and true with the face.

Weathering and Drips.—All the sills, cornices, copings and projecting courses to be properly weathered, and to have a water-drip cut on underside to take the water from face of wall. The door and windowsills to have seats for jambs and mullions where shown by the details. The top course of stone under window-sills to be cut down 1″ clear through, square with the face, for cold-air inlet to heating coils; the stones under mullioned windows to have seats left for support of sills on line with mullions. Where no air-space is needed under sills their beds should only have bearings immediately below jambs and mullions.

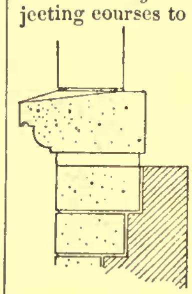


Fig 7.

The cornices and coping-stones to be dished and graded for gutters (which will be lined with copper by the Government). Holes for down-pipes to be cut through all stone where required.

The joints for stone floors of porticos or balconies may be splayed or rabbetted, as per sketches, and close-jointed at the bottoms and grouted full and flush with Portland-cement mortar. The floors to be properly weathered.

The stonework of chimneys and vent-shafts to start at least 6″ below roof-lines; the cap-stones for vent-shafts to cover the full thickness of the wall and the cap-stones for chimneys to be one stone each and perforated for flues: each hole to be full size of flue.

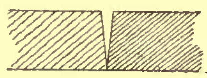


Fig. 8.

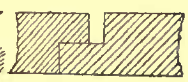


Fig. 9

Chases to be cut into stonework of walls of building where area walls and cross walls return against it, to prevent the cracking of walls where joined, as the settlement of building will be greater than that of the area walls.

The stone slabs for dormer roofs to be in one piece for each slope, to extend 4″ at edges under the gable coping, main roof and ridge, and to be securely anchored and cramped.

Arches.—The joints of all voussoirs or arches to be rubbed to a true surface and to radiate from centres. The contractor to furnish the material, build and properly set all the wooden centres required for building the stone arches, which must not be struck or eased until the mortar is thoroughly set.

The balusters to have tenons 2″ square and ½″ long cut on bottoms and tops and properly let into mortises in base and capping of balustrade, and the latter to be let into the capping of pedestals not less than 2″.

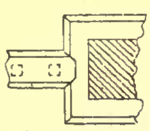


Fig. 10.

Steps.—Where steps are built in between walls they should be housed into stone not less than 2″ and have a bearing on brick of 4″, and where joints occur in their lengths they must be well caulked flush with lead.

Finials.—The stone finials to have as broad bearing-beds as practicable, to have tenons let into mortises, and in addition, to have copper or lead dowels wedged and secured into stone as tightly as possible.

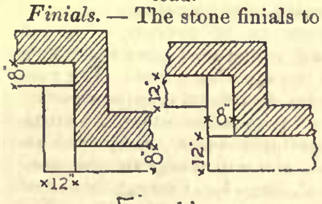


Fig. 11.

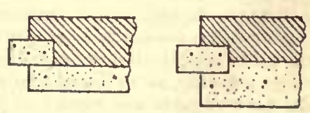


Fig. 12.

At all reëntering angles the stones to be full width of the courses, and each alternate course to break joint as per Figure 11.

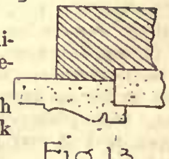


Fig. 13.

Where jamb stones are used at openings they should either extend back of the ashlar and check into each alternate

course, as per Figure 12, or the ashlar should extend into a rabbet in the jamb about 1″, as in Figure 13.

Corbels and Projecting Courses. — Corbels for supporting walls, etc., to be in one piece, and the end or ends built into the walls sufficiently for the weight above the ends to more than counterbalance the projecting weight. Projecting turrets to have long, wrought-iron rods anchoring them into main walls on each side every 6′ apart in height.

All projecting courses, sills, architraves, cornices, heads of openings, etc., to have a depth in wall not less than the greatest width of ashlar, and the depth in wall should never be less than its extreme projection beyond face of wall, in order that the stone may rest securely on the wall by its own weight.

Gable coping, where practicable, and not marring the design, should be stepped on underside so that level bearings may be had; where it is not stepped on underside then the entire coping on both sides of apex should be securely cramped together and fastened by copper or slate dowels to the wall on which it rests.

Where the down-spouts discharge the water on the surface, stones 2′ x 1′ 6″ x 6″ to be provided dished 2″ deep, and have channel cut to carry water away from building and set in place, the top about 1″ above sidewalk or gutter.

Approaches. — The work on approaches is always contracted for separately from the building, and is generally the last work done.

The stonework to be cut to the designs and dimensions, and placed in positions shown on the approach plan. The gate and fence posts to be in one piece, to be set in the ground about three or four feet on a bed of concrete or broken stone, and the earth rammed solidly around them.

The buffer or wheel-block at main entrance to be of granite, set in the ground against a wall, or built into the wall, and to have sufficient projection and height above ground to prevent the wagon-wheels from striking against platform or supporting wall; the upper outer edge of buffer to be rounded, and the exposed surface to be Number 6 cut-work.

The gate posts for their exposed angles to be provided with three-quarter round sugar-loaf granite fenders, and to have a granite stop 6″ or 8″ square placed midway between posts, with hole in centre for dropping rod of iron gate into and stops to hold each leaf of the gates open; the fenders and stops to be set 1′ 6″ or 2′ 0″ into ground and to be solidly rammed.

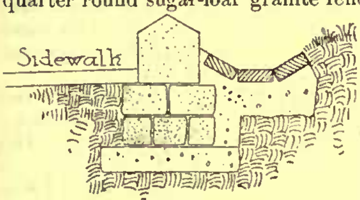
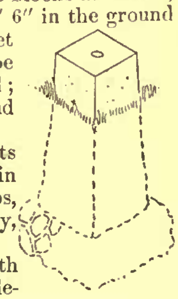


Fig. 14.

Fence Coping. — For supporting iron fences around the buildings and lots a brick or rubble wall with granite coping and usually a base of concrete will be built having sufficient depth to get below frost generally two or three feet below surface; the exposed coping to be Number 6 cut-work and 10″ or 12″ wide, weathered as shown by Figure 14. Instead of a wall and coping a solid stone 8″ to 12″ wide, about three feet deep, may be firmly bedded in the ground on a concrete base and securely rammed; a brick or concrete gutter to be laid against these copings for draining the lot.

Where the above copings are too expensive, stone blocks are used; these are to be 8″ or 10″ square at top, set about 2′ 6″ in the ground on a bed of broken stone, spaced about eight feet apart and solidly rammed; the iron fence posts to be let into the hole in centre of each block and leaded; in this case a thin blue stone or bricks set on end are used as curbing between sidewalk and grass.


Fig. 15.

Quarry Beds. — All stone to be cut to lie on its quarry or natural bed (where possible), except in case of columns, pilasters, voussoirs, mullions, jambs, panels, etc., which may be set on edge or vertically, as the case may require.

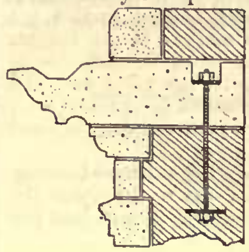
Patching. — No patching nor hiding of defects with composition of any kind will be allowed, and all defective stone or work will be rejected, and the contractor must make good such rejected work without unnecessary delay.

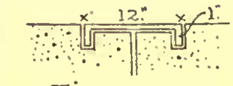
Lewis Holes. — No lewis holes to show on steps, platforms, copings, etc., or where they would be exposed to the weather.

Cramps and Anchors. — The stones to be properly cramped each to each, and to be anchored and cramped to brick backing wherever necessary and as directed by superintendent. The contractor to supply all dowels, anchors, pins, and metal cramps securing stones together as required and shown on detail or other drawings. The Government will supply all the galvanized-iron cramps and anchors for securing stone to brickwork, and will designate the positions, and the contractor to make the sinkings for, thoroughly embed in mortar and properly build-in all the cramps, anchors, etc. The exposed dowels for dormers, finials, and chimneys to be copper, and all cramps, anchors, etc., where possible, to be galvanized.

Each stone in courses of heavy projection, main cornices and copings to be anchored into brickwork by a rod $\frac{3}{4}$″ diameter, 3′ or 4′ long, with plate on end 12″ x 4″ x $\frac{1}{2}$″ built in brickwork and the upper end of rod passing through stone and secured by nut with washer.

The stones to be cramped each to each by cramps 12″ long by 1″ wide by $\frac{3}{16}$″ thick; let 1″ into each stone flush with the surface and grouted full with liquid mortar. The stones will also be secured to brickwork by cramps from 12″ to 16″ long by $1\frac{1}{4}$″ wide by $1\frac{1}{4}$″ thick, let $1\frac{1}{2}$″ into stone and turned up 4″ and extend into the brickwork one brick's length from back of stone above cramp, one to each stone where stones are large, and where stones are small, one to every two or three stones may be sufficient. The stones of random ashlar are not to be cramped together, but must be cramped or anchored to brick backing, about three cramps in every square yard of wall.


Fig. 16.


Fig. 17.

Mortar. — The mortar for all footings, rubble, and unexposed stonework to be best quality, composed of one (1) part cement equal to the United States Government brand, and two (2) parts clean, sharp sand, measure for measure, and a quantity of stone-lime paste equal to one-third ($\frac{1}{3}$) of the quantity of the cement, all thoroughly mixed immediately before use, and to be used, if possible, before the first set.

The mortar for all exposed stonework to be composed of the best quality of stone-lime (wood burned preferred), and clean, sharp sand mixed in the proportions of one-third ($\frac{1}{3}$) lime to two-thirds ($\frac{2}{3}$) sand, measure for measure. The lime to be slaked and left to sour as long as possible before using.

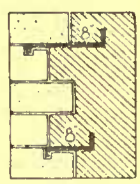
Setting. — All the stone to be bedded and jointed in lime-mortar, set with open joints; and plastered on the back with lime-mortar, or covered with a coat of a mixture composed of one-quarter rosin or asphalt to three-quarters coal-tar, applied while hot, to prevent the stain from the cement-mortar used for brick from discoloring the stone.

The horizontal courses of stonework to be kept perfectly level throughout, and the walls to be built up uniformly; that is, no portion must be carried higher than 4′ 6″ before the remainder is brought to the same level, unless especially ordered by the superintendent.

The stone must be set in proper consecutive order and no detention or delay will be allowed on account of brickwork, backing, etc.

Protection of Work. — All projections, mouldings, angles, sills, steps, copings, door and window jambs, buttresses, etc., to be substantially protected by boards, etc., from injury during construction. The work, as it progresses, must also be kept covered with boards when exposed to the weather, rain, etc., and, if considered necessary by the superintendent, must be thus covered whenever leaving off work. The contractor to furnish all lumber, nails, etc., and labor necessary for such protection, and to maintain same until the completion of the work.

Washing down and Pointing. — At completion the contractor will be required to wash down all the exterior stonework, to rake out the joints to a depth of $\frac{3}{4}$″ or 1″ and point the same flush with lime-putty and sand, colored to match the stone; the pointing to be finished as per Fig. 19, and leave the work clean.


Fig. 18.

Thickness of Walls. — The stone facing of a wall is not considered in determining its thickness; it is the custom to make the brick backing sufficiently strong to carry the weight of superimposed loads, which is, generally speaking, the thickness as established by the building-law in New York City, and the stone facing may be considered as giving so much additional strength; but this does not appear to be excessive when it is known that it is the general practice to make 4″ air-spaces in all exterior brick walls, which, of course, would be weaker than solid walls without air-spaces.

Where basement walls are built of solid random rubble the walls should be not less than 8″ thicker than if built of brick, but where built of squared masonry, they are made the same thickness as brick walls.

Area walls, when short and having returns against walls of building, should be not less than 12″ thick; if they have stone facing, the backing, if brick, should be not less than 8″, and if stone, should be not less than 12″ thick; walls 20′ long and over should be treated as retaining-walls.

Retaining-Walls. — Retaining-walls are generally built of coursed ashlar with brick backing, or coursed masonry with squared rubble backing laid up in the best cement-mortar on a good concrete foundation, which must be carried beyond reach of frost. The earth, where coming against the wall, is always levelled off to the height of top of wall for a safe distance back of it.

The face of the wall to have a batter of 1″ or $1\frac{1}{2}$″ to every foot in height, and the back to be stepped about 4″ every 2′ in length, and the wall to have a heavy stone coping not less than 12″ thick the full width of the wall, with a projection of 1″ or $1\frac{1}{2}$″ beyond the face: the stones to be in long lengths.


Fig. 19.

The stone masonry wall with rubble backing to have a thickness equal to $\frac{35}{100}$ of its height from concrete foundation to top of coping; this thickness to be taken at one-third ($\frac{1}{3}$) of the height, and the batter on face and stepping on back to be determined from this point. At back of wall there will be a gutter laid on a concrete base and the space from outer edge

of gutter down to level of ground-line on front, to be filled with broken stone; the opening through wall for passage of gutter drain-pipes to be sufficiently large to allow any water which may accumulate below the surface to escape; these openings should not be over twenty feet apart; below this broken stone to top of concrete foundation to be filled-in solidly with concrete.

The beds are all horizontal and the joints vertical; the beds are seldom made normal to batter, as recommended by many engineers.

The coursed-ashlar wall with brick backing to have a thickness equal to $\frac{1}{10}$ of the height of wall, and to have a gutter and filled-in with broken stone and concrete, as described for stone-masonry-wall. The back of brick to have a coating of asphalt or tar.

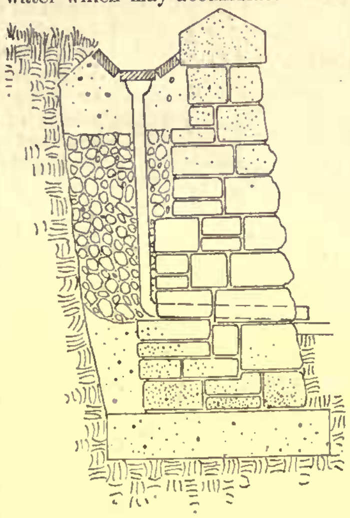


Fig 20.

Sizes of Piers and Columns.— All detached stone piers, columns, etc., should have a weight on them not exceeding one-eighth ($\frac{1}{8}$) of the crushing strength per square foot, and the height should be not over ten or twelve times the smallest diameter or side. The crushing strengths of the principal building stones in use can be found in most any engineer's or architect's pocket-book, and need not be mentioned here.

PRESERVING OR WATERPROOFING STONE.

It is sometimes necessary to use some process to preserve stone from disintegrating under the action of the weather, but it is the best plan, to select stone of such character as to be practically imperishable and need no artificial assistance for preservation, and it has been the object of the Government to use only such stone. In very few instances has it been found necessary to use a preservative.

The process for preserving stone given by Mr. Powell in his work on "*Foundations and Foundation Walls*" and those mentioned in the *American Architect* of March 19, 1887 have not been tried by the Government.

The materials for preserving stone should be colorless, easily absorbed by and thoroughly incorporated with the stone, and should be imperishable and irremovable.

The only process used by the Government for many years is what is known as "Wheaton's Process." It is manufactured and applied to walls by The National Brick and Stone Preserving Co., of Washington, D. C.: there is no patent on the mixture they use, but the ingredients are known only to the manufacturers. It has not been in use a year yet, and of course experience and a test of years can only prove what is claimed for it, which is that it is absolutely imperishable and needs no renewing. It is a dark liquid without any vegetable elements in it and should be applied to stone or brick with a brush at a temperature not colder than fifty degrees, but the warmer the better, and should have two coats applied, with a short time intervening between the applications.

A piece of Seneca brownstone was treated by this process. Water dropped on it remained in a globular state and not a particle was absorbed: after holding the stone in water and then breaking it, the water appeared not to have penetrated in the slightest: while water dropped on the untreated stone was absorbed almost as readily as if dropped on raw cotton. It makes the stone a scarcely perceptible shade darker, but leaves the color perfectly uniform and not the slightest appearance to indicate that the stone has been treated, except by comparison with an untreated stone.

MEASUREMENTS, CUTTING, ETC.

Rubble-work is sometimes estimated by the cubic yard, or perch ($24\frac{3}{4}$ cubic feet) but generally by the cubic foot: all other stonework, ashlar, dimension and cut stone, is estimated by the cubic foot.

In measuring rubble, solid masonry walls, and random ashlar, the length multiplied by the average thickness by the height of the wall is to be taken to obtain the cubic feet; no allowance to be made in the measurement for wastage, but in the price. Where a uniform projection of rock-facing is required it is to be added to the thickness of the stone to obtain the cubic feet: the object being to obtain the actual number of cubic feet contained in the completed wall, taking the extreme dimensions for all stones.

All coursed, dimension and cut stonework should be measured course by course, or piece by piece. Dimension stone should be considered as each piece measured and the cubic feet obtained separately: of course where a number of stones have two dimensions the same and their lengths different, it saves much time and is just as correct to add all the lengths together and multiply by the width and height.

In making schedules of stone each course and different class of work should be kept separate and classified under its proper course or architectural name of its position in the building; each stone should have its dimensions (first the length, then the width or depth in wall and last the height) set down separately; of course where there are a number of stones of exactly the same size and similar, the number of stones with size of each need only be given.

The simplest rule for scheduling the dimensions of irregularly shaped stones and, of course, this applies where acurate detail measurements are desired, is, to take the dimensions of the smallest rectangular prism out of which a stone can be cut. The actual net dimensions figured on the drawings to be taken: as before stated no allowance for wastage in quarrying is now made.

Generally the entire quantity of stone in a contract is measured and an average price put upon the whole; sometimes each course or different class of work is measured and priced separately: a simpler plan which is almost as accurate is to measure and price out the work separately in the following classes, namely: random-rubble, squared masonry, coursed masonry, random ashlar, rock-face coursed ashlar, piers, bearing-stones, plain dressed ashlar, moulded-work, and carved-work; of course for very ornamental and elaborate carving each piece should be considered separately.

Cutting.— After the stone has been divided in the above mentioned classes, a few stones in each class may be estimated and the price so obtained, taken as the price per cubic foot for that class of work, which must include furnishing the rough stock, dressing it to the dimensions and designs shown on the drawings and setting it in the building complete.

To estimate the cost of a cubic foot of stone the proper plan to pursue is: take one stone, a fair average in size for the rest, obtain the number of cubic feet, multiply by the cost of the rough stock, which must include delivering the stone on the site and setting; measure the superficial feet of bed, build and joints (the bed is the bottom on which it rests, the build is the top on which another stone rests, the joints are the surfaces which come in contact with other stones; where the backs are pitched off no account is taken of it, but where they are pointed the square feet of backs are added to bed and joint work) and the whole multiplied by the cost of cutting bed-work; measure the superficial feet of plain face-work and multiply by the proper price for this work and in same manner estimate the moulded and carved work: adding together the entire cost of rough stock and of cutting all surfaces of the stone, and dividing by the number of cubic feet in the stone will give the cost per cubic foot.

Bed and joint work should be measured the extreme length by the extreme width of the stone, all other cutting, face-work, moulding, carving, etc., should be taken only by the actual net measure. The lengths of all mouldings should be taken to the extreme angles both external and re-entering and it is customary to allow from 6″ to 1 foot additional in length to pay for forming each mitre.

All surfaces which are sunk below a projection and which are bevelled, that is, not at right angles, are considered sunk surfaces, and should be measured and estimated separately.

The cost of cutting varies according to the hardness, etc., of the stone, and is governed by the prices of the stone-cutters' unions in various localities. The unions in most cities from time to time adopt prices and rules of measurement for cutting stone, which differ greatly and are very confusing: in many instances they double, and sometimes treble, the measurement, so as to keep the same price. This should never be done: a standard system should be adopted, to properly classify each different kind of labor in cutting, to measure the actual net-surface cut, and to make the proper allowance in price for the cost of cutting each different kind; and this is the plan which has been uniformly followed by the Government.

Granite-cutters do not cut soft stone, and cutters of soft stone, marble, limestone, sandstone and freestone do not cut granite; their organizations, wages and methods of cutting being different.

Cost of Cutting.— Sunk-bed and joint-work costs from $1\frac{1}{4}$ to $1\frac{3}{4}$ times plain bed-work, and circular-bed and joint-work from $1\frac{1}{2}$ to 2 times plain bed-work.

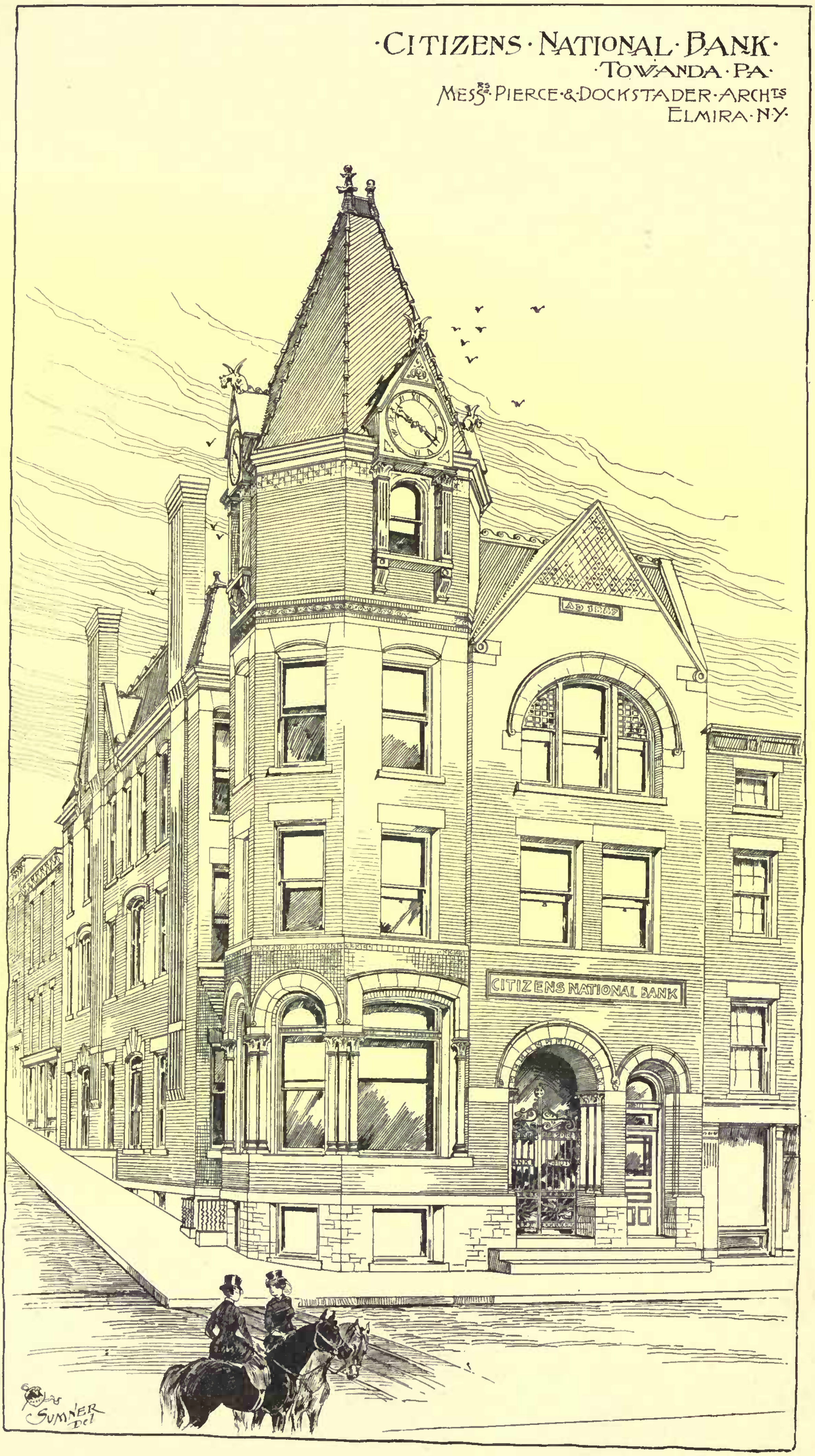
Plain-face costs from 2 to 3 times bed-work.
Sunk " " $1\frac{1}{4}$ to $1\frac{1}{2}$ " plain-face.
Circular-face " $1\frac{1}{2}$ to 2 " "
Moulded-work costs from $2\frac{1}{2}$ to 5 times plain-face.
Circular moulded-work costs about 2 times plain moulding.

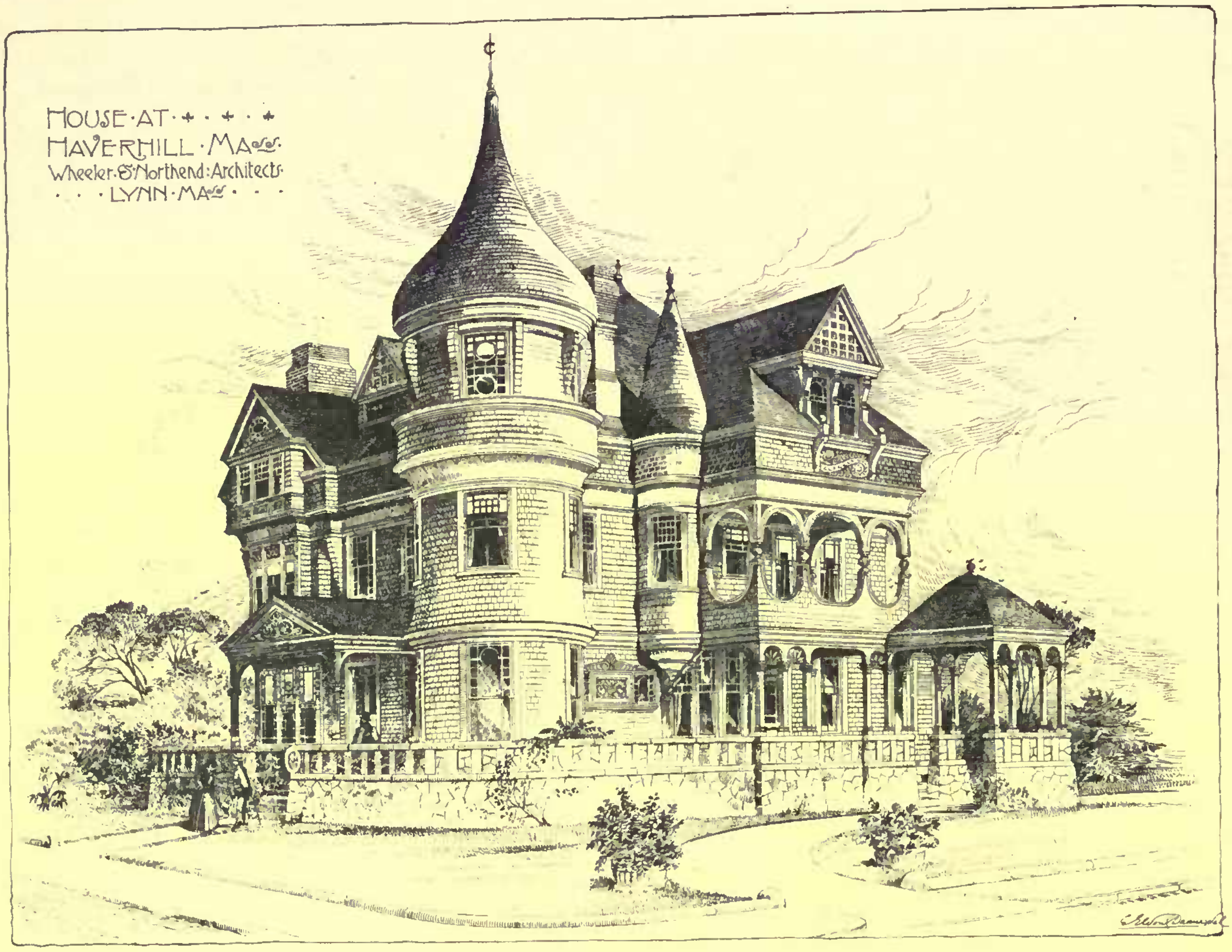
AVERAGE COSTS OF CUTTING PER SQUARE FOOT.

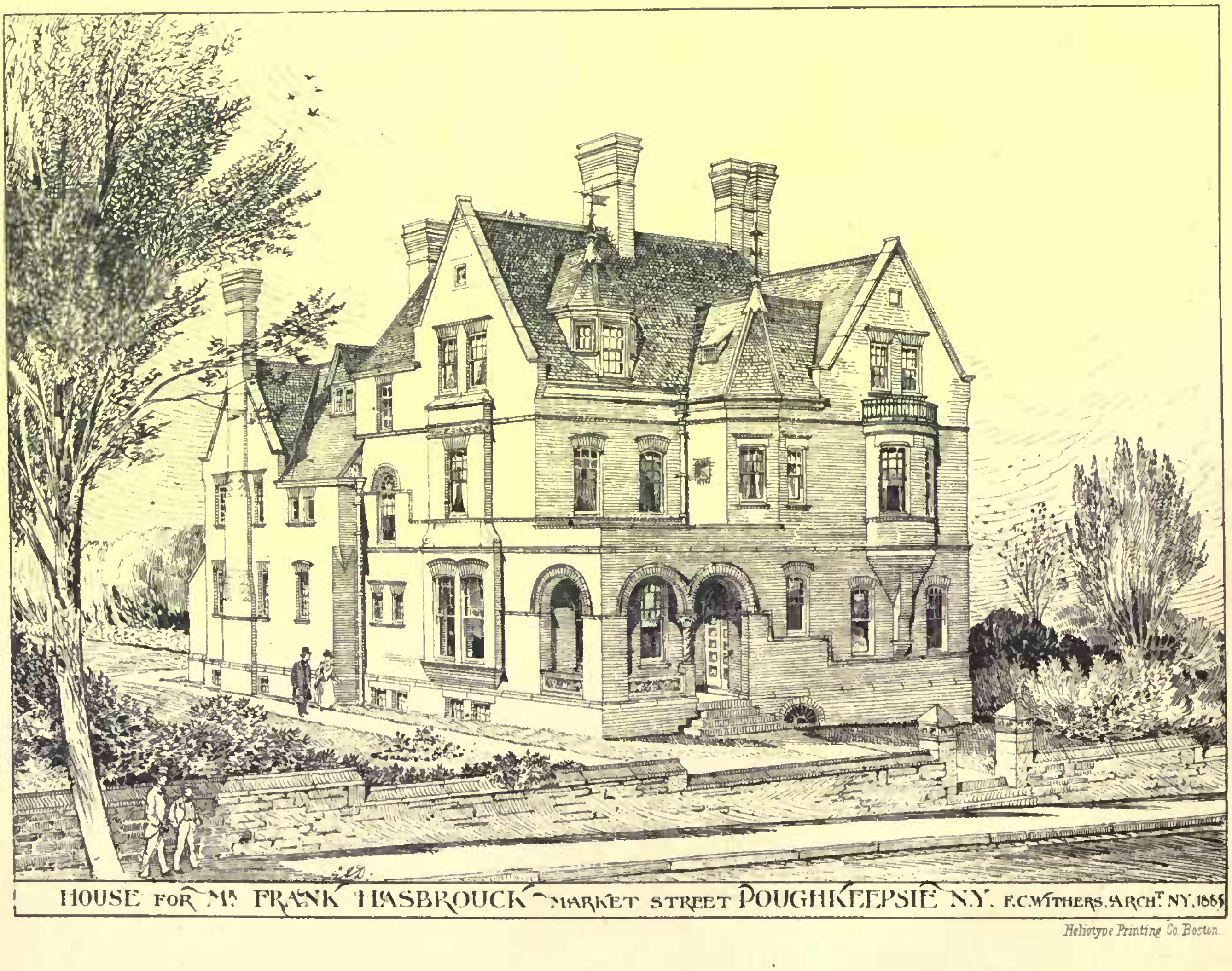
Kind of Work.	Granite.	Marble.	Lime and Sandstones.
Beds and joints	$ .30 to .35	$ .20 to .25	$ .12 to .15
Pean-hammered........	.45 to .50	.30 to .35	.15 to .20
Plain-face..............	No. 6 cut, .65 " 8 " .75 " 10 " .88 " 12 " 1.10	.40 { Rubbed and drove. } .50 Tooled	.20 to .25 .25 to .30

Polishing granite costs from $1.50 to $2.00 per square foot, in addition to cost of plain face-work. No definite cost can be given for carved-work, as it depends entirely upon the design. It has cost in granite from $5.00 up as high as $30.00 per square foot, and in soft stones, from $3.00 to $15.00

Cost per cubic foot.— The cost per cubic foot of stonework depends upon the cost of quarrying or furnishing the rough stock, delivering the stone at the site of the building, stone-cutters' wages per day and setting the stone in place in the building.

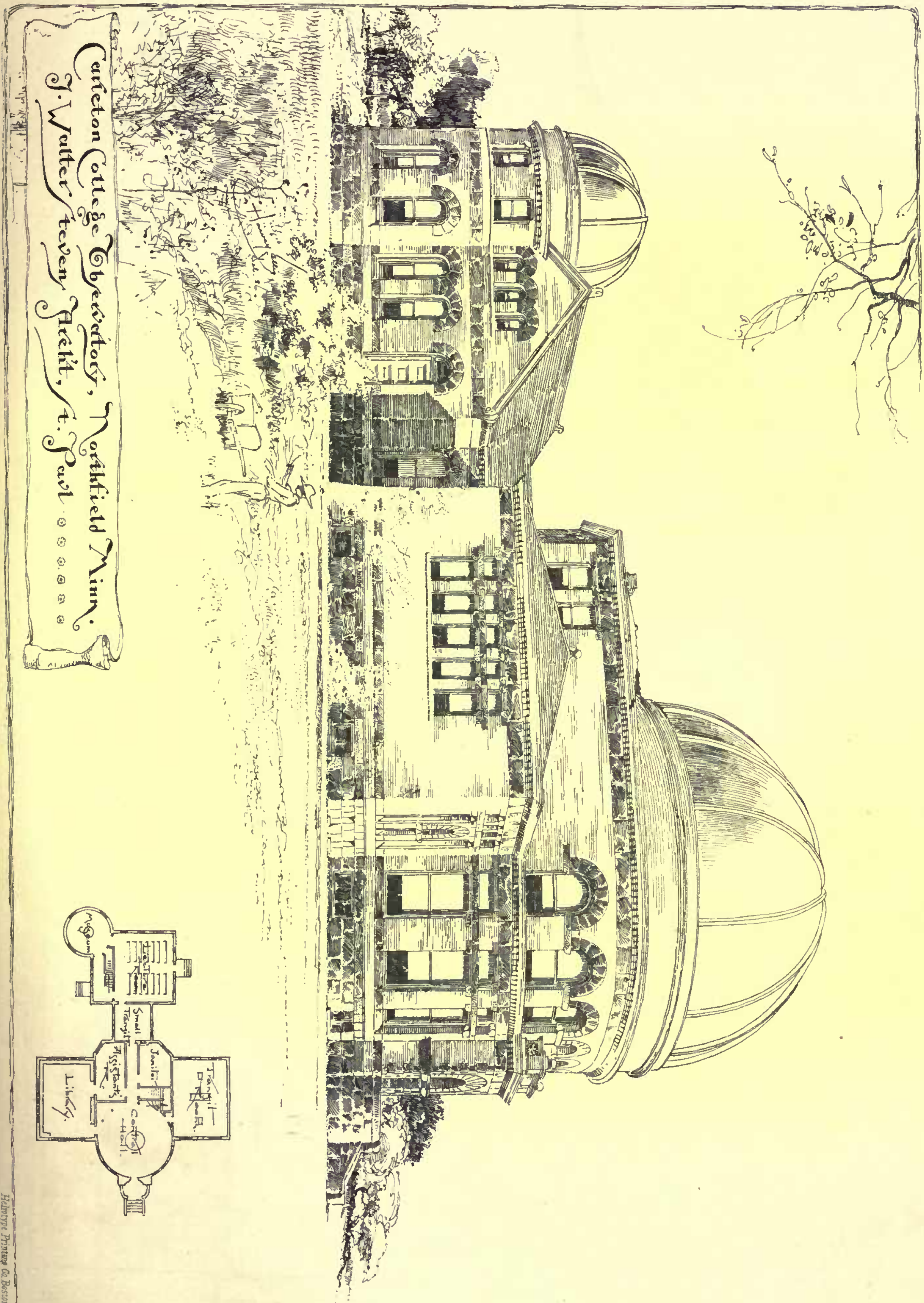

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AD 1887
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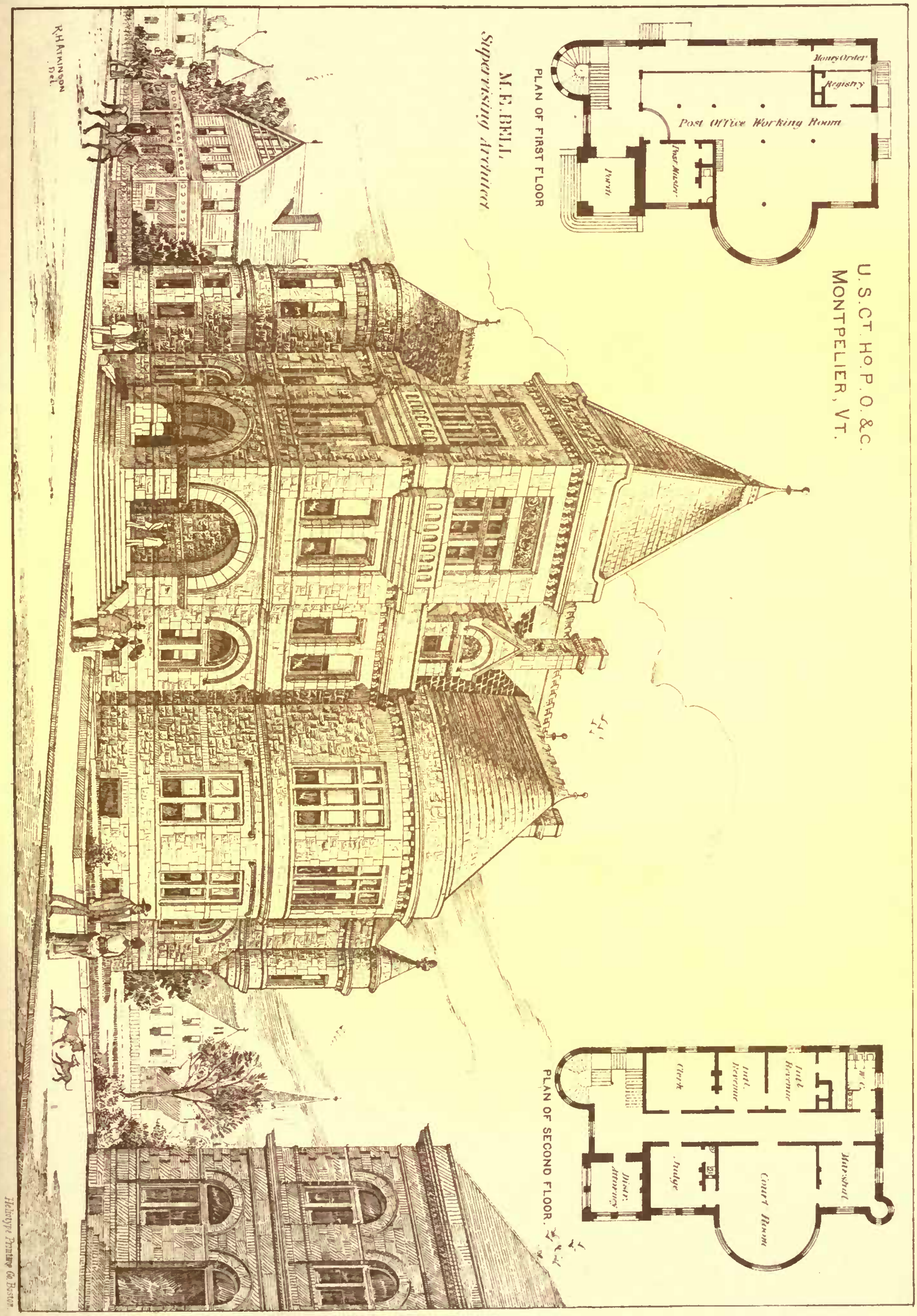
HOUSE FOR Mr FRANK HASBROUCK MARKET STREET POUGHKEEPSIE N.Y. F.C. WITHERS, ARCHT. NY. 1885

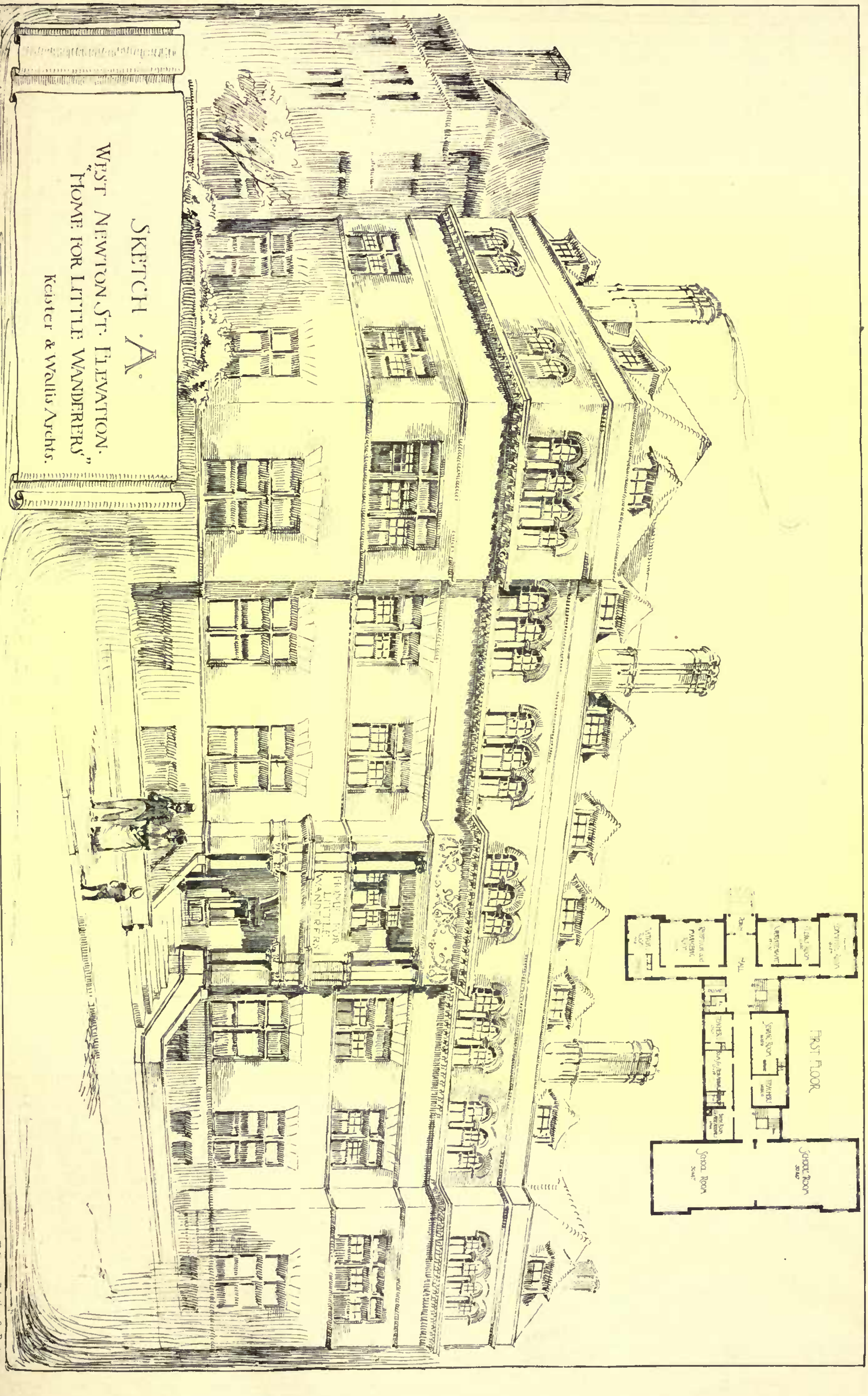
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AMERICAN ARCHITECT AND BUILDING NEWS, JULY 2 1887 No. 601.





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ACTUAL COST OF STONE FURNISHED, CUT AND SET, PER CUBIC FOOT.
(In some instances bids are given when so stated.)

Kind of Work.	Place.	Date.	Cost.
Random rubble, limestone	Harrisburg, Va.	1885	$ .20
" "	Cincinnati, O.	1884	.20
" "	Denver, Col.	1883	.20
" sandstone	Pittsburgh, Pa.	1886	.35
Squared masonry, sandstone	"	1885	.60
Coursed " "	"	"	.70
Squared " limestone	Columbus, O.	1884	.68
" " granite	Memphis, Tenn.	1886	.30
Rock-face ashlar "	Pittsburgh, Pa.	1886	1.38
" " and cut stone granite, avg	"	"	1.60
Cut-granite basement and area walls	"	"	2.00
Rock-face ashlar and cut and moulded trimmings, Stony Point, Mich., sandstone	Ft. Wayne, Ind.	1885	1.52
Trimmings, Bedford limestone. *Bid*	"	"	1.65
Rock-face ashlar, granite, retaining wall	Memphis, Tenn.	1886	1.00
Dressed coping " "	"	"	2.50
White sandstone. Furnish only	Dallas, Tex.	1885	.35
Armijo " "	Denver, Col.	"	.73
Cut and moulded sandstone of superstructure	Council Bluffs, Ia.	"	1.91
" " " average bid	" "	"	2.12
" " limestone, lowest "	" "	"	1.87
" " " average "	" "	"	2.33
Rock-face aslar, cut and moulded trimmings, Middlesex brownstone	Rochester, N. Y.	1884	2.41
Cut and moulded Bedford limestone	Louisville, Ky.	1885	2.00
" " sandstone	Dallas, Tex.	"	2.46
" " limestone	Hannibal, Mo.	"	1.83
" " sandstone	Des Moines, Ia.	1887	2.27
" " granite, superstructure	Pittsburgh, Pa.	1886	3.00

The average cost to furnish and cut only, the granite for the superstructure of the Baltimore Post-office, etc., in 1884, was $2.54 for cut, ashlar, moulded and carved trimmings, or average for plain ashlar, $1.40; for moulded-work, $3.00, and for carved-work, $6.50 per cubic foot.

The best general idea of the cost of furnishing rough stone, and the cost to furnish, cut and set the stone, may be obtained by giving the lowest and the average of the thirty-five bids received for the stonework of the Brooklyn Post-office, opened in 1885. The basement and first story were built of rock-face, coursed ashlar, the second story and all the trimmings, of dressed-work, with a good deal of moulded and carved work.

KIND OF STONE.	Rough Stone per cubic foot.	Furnish cut and set per cubic foot.
Granite, accepted bid	$ .58	$2.02
Granite, average bid	.70	2.71
Marble lowest bid	1.50	2.92
Marble, average bid	1.66	3.06
Bedford limestone, lowest bid	.90	1.92
Bedford limestone, average bid	.85	2.07
Amherst and Berea S'dtones, lowest bid	.90	2.00
Amherst and Berea S'dtones, average "	.90	2.20
Brown-stone, lowest bid	1.19	2.10
Brown-stone, average bid	1.15	2.31

JAS. E. BLACKWELL.

[To be continued.]

THE ILLUSTRATIONS

[*Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.*]

HOUSE OF ROBERT GOELET, ESQ., NEWPORT, R. I. MESSRS. MCKIM, MEAD & WHITE, ARCHITECTS, NEW YORK, N. Y.

[Gelatine Print, issued only with the Imperial Edition.]

A CLOCK-TOWER, DESIGNED BY MR. W. J. POLK, KANSAS CITY, MO.

THIS design was placed first in a competition, recently held by the Kansas City Architectural Sketch Club, in conformity with the subjoined recommendations:

A GOOD design well rendered in a free, clear, pen-and-ink drawing. The general distribution of parts very pleasing and effective; the transition from the square clock-stage to the lantern, with the canted corners, is skilfully managed, and the author exhibits the rare virtue of knowing where to hold his hand, as there are large and effective areas of repose enhancing the value of the richer parts; the triple arcade is well rendered and keeps safely and prudently within the limits of conventional style; the solid balcony is a very valuable adjunct to the design, and is well composed; the cornice of the lantern is good, and the roof-slope finishes the composition very effectively. The little corbelled string-course, under the clock-stage, would have been insufficient without the low range of square windows underneath, the mullions of which are very properly strong and vigorous.

HENRY VAN BRUNT,
FRED'K B. HAMILTON, } *Jury.*
ADRIANCE VAN BRUNT.

ASTRONOMICAL OBSERVATORY, "CARLETON COLLEGE," NORTHFIELD, MINN. MR. J. W. STEVENS, ARCHITECT, ST. PAUL, MINN.

THE structure is now nearly completed and will cost $29,000. The observatory will be equipped with one nine-inch equatorial, one sixteen-inch equatorial, also, one large and one small transit.

CITIZENS' NATIONAL BANK, TOWANDA, PA. MESSRS. PIERCE & DOCKSTADER, ARCHITECTS, ELMIRA, N. Y.

THE building is of pressed-brick and brownstone, with diamond tile roof, copper cornice. The bank is to be finished in cherry, the other rooms in native woods. Dimensions, 30′ x 83′. It will cost, complete, about $18,000.

UNITED STATES POST-OFFICE AND COURT-HOUSE, MONTPELIER, VT. MR. M. E. BELL, SUPERVISING ARCHITECT.

HOUSE AT HAVERHILL, MASS. MESSRS. WHEELER & NORTHEND, ARCHITECTS, LYNN, MASS.

COMPETITIVE DESIGN FOR HOUSE FOR LITTLE WANDERERS, BOSTON, MASS. MESSRS. KEISTER & WALLIS, ARCHITECTS, NEW YORK, N. Y.

HOUSE OF FRANK HASBROUCK, ESQ., POUGHKEEPSIE, N. Y. MR. F. C. WITHERS, ARCHITECT, NEW YORK, N. Y.

SAFE BUILDING.—XVII.[1]



IT is generally best to build the flue of a chimney plumb from top to bottom, and, of course, of same area throughout. Sometimes the flue is gradually enlarged towards the top for some five to ten feet in height, which is not objectionable, and the writer has obtained good results thereby; some writers, though, claim the flue should be diminished at the top, which, however, the writer has never cared to try. Galvanized iron bands should be placed around the chimney at intervals, particularly around the top part, which is exposed very much to the disintegrating effects of the weather and the acids contained in the smoke. No smoke flue should ever be pargetted (plastered) inside, as the acids in the smoke will eat up the lime, crack the plaster, and cause it to fall. The crevices will fill with soot and be liable to catch fire. The mortar-joints of flues should be of cement, or, better yet, of fire-clay, and should be carefully struck, to avoid being eaten out by the acids.

Tops of Chimney Flues.

Calculation of Walls.—Bulging.

Where walls are long, without buttresses or cross-walls, such as gable-walls, side-walls of building, etc., we can take a slice of the wall, one running foot in length, and consider it as forced to yield (bulge) inwardly or outwardly, so that for ρ^2 we should use:

$$\rho^2 = \frac{d^2}{12}$$; where d the thickness of wall in inches. The area or a would then be, in square inches, $a = 12.d$.

Inserting these values in formula (59) we have for

BRICK OR STONE WALLS.

$$w = \frac{d.\left(\frac{c}{f}\right)}{0{,}0833 + 0{,}475.\frac{L^2}{d^2}} \qquad (62)$$

Where $w =$ the safe load, in lbs., on each running foot of wall (d'' thick).

Where $d =$ the thickness, in inches, of the wall at any point of its height.

Where $L =$ the height, in feet, from said point to top of wall.

Where $\left(\frac{c}{f}\right) =$ the *safe* resistance to crushing, in lbs., per square inch, as given in Table V.

If it is preferred to use tons and feet, we insert in formula (60): for $A = D$, where D the thickness of wall, in feet, and we have:

$$P^2 = \frac{D^2}{12}$$; therefore

$$W = \frac{D.\left(\frac{c}{f}\right)}{14 + 0{,}552.\frac{L^2}{D^2}} \qquad (63)$$

[1] Continued from page 275, No. 597.

Where W = the *safe* load, in tons, of 2000 lbs., on each running foot of wall (D feet thick).

Where D = the thickness of wall, in feet, at any point of its height.

Where L = the height, in feet, from said point to the top of wall.

Where $\left(\frac{c}{f}\right)$ = the safe resistance to crushing of the material, in lbs., per square inch, as found in Table V.

Anchored Walls. Where a wall is thoroughly anchored to each tier of floor beams, so that it cannot possibly bulge, except between floor-beams, use the height of story (that is, height between anchored beams in feet) in place of L and calculate d or D for the bottom of wall at each story.

The load on a wall consists of the wall itself, from the point at which the thickness is being calculated to the top, plus the weight of one foot in width by half the span of all the floors, roofs, partitions, etc. Where there are openings in a wall, add to pier the proportionate weight which would come over opening; that is, if we find the load per running foot on a wall to be 20000 lbs., and the wall consists of four-foot piers and three-foot openings alternating, the piers will, of course, carry not only 20000 lbs. per running foot, but the 60000 lbs. coming over each opening additional, and as there are four feet of pier we must add to each foot $\frac{60000}{4}$ = 15000 lbs.; we

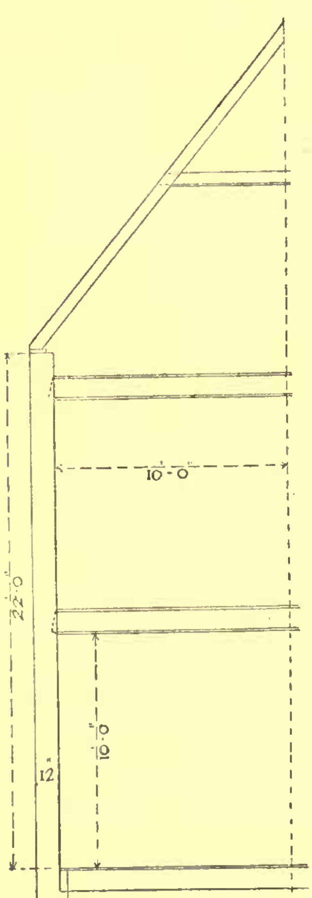


Fig. 88.

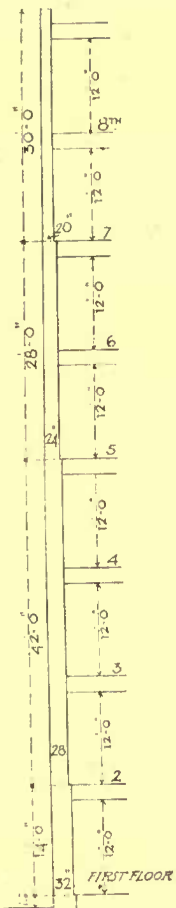


Fig. 89.

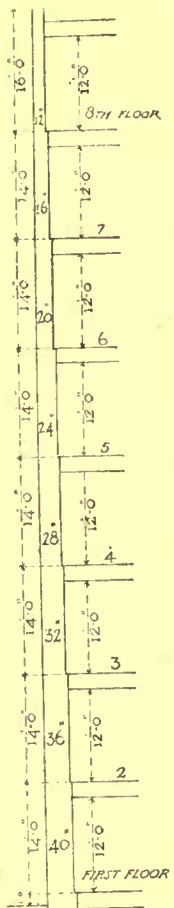


Fig. 90.

therefore calculate the pier part of wall to carry 35000 lbs. per running foot. The actual load on the wall must not exceed the safe load as found by the formula (62) or (63).

Example.

Wall of Country House. *A two-story-and-attic dwelling has brick walls 12 inches thick; the walls carry two tiers of beams of 20 feet span; is the wall strong enough? The brickwork is good and laid in cement mortar.*

We will calculate the thickness required at first story beam level, Figure 88.

The load is, per running foot of wall:

Wall	= 22.112 =	2464 lbs.
Wind	= 22. 15 =	330 lbs.
Second floor	= 10. 90 =	900 lbs.
Attic floor	= 10. 70 =	700 lbs.
Slate roof (incl. wind and snow)	= 10. 50 =	500 lbs.
Total load	=	4894 lbs.

For the quality of brick described we should take from Table V:

$$\left(\frac{c}{f}\right) = 200 \text{ lbs.}$$

The height between floors is 10 feet, or

L = 10,

therefore, using formula (62) we have:

$$w = \frac{d.\left(\frac{c}{f}\right)}{0{,}0833 + 0{,}475.\frac{L^2}{d^2}} = \frac{12.200}{0{,}0833 + 0{,}475.\frac{10.10}{12.12}} = 5807 \text{ lbs.}$$

So that the wall is amply strong. If the wall were pierced to the extent of one-quarter with openings, the weight per running foot would be increased to 6525 lbs. Over 700 lbs. more than the safe load, still the wall, even then, would be safe enough, as we have allowed some 330 lbs. for wind, which would rarely, if ever, be so strong; and further, some 1200 lbs. for loads on floors, also a very ample allowance; and even if the two ever did exist together it would only run the compression $\left(\frac{c}{f}\right)$ up to 225 lbs. per inch, and for a *temporary* stress this can be safely allowed.

The writer would state here, that the only fault he finds with formulæ (59), (60), (62) and (63), is that their results are apt to give an excess of strength; still it is better to be in fault on the safe side and be sure.

Example.

Walls of City Warehouse. *The brick walls of a warehouse are* 115 *feet high, the* 8 *stories are each* 14 *feet high from floor to floor, or* 12 *feet in the clear. The load on floors per square foot, including the fire-proof construction, will average* 300 *lbs. What size should the walls be? The span of beams is* 26 *feet on an average.*

According to the New York Building Law, the required thicknesses would be: first story, 32″; second, third, and fourth stories, 28″; fifth and sixth stories, 24″; seventh and eighth stories, 20″.

At the seventh story level we have a load, as follows, for each running foot of wall:

Wall	= 30.1⅔.112 =	5600
Wind	= 30.30 =	900
Roof	= 13.120 =	1560
Eighth floor	= 13.300 =	3900
Total	=	11960 lbs., or 6 tons.

The safe load on a 20″ wall 12 feet high, from formula (63) is:

$$W = \frac{1\tfrac{2}{3}.200}{14 + 0{,}552.\frac{12.12}{1\tfrac{2}{3}.1\tfrac{2}{3}}} = \frac{333}{14 + 0{,}552.51{,}84} = 7{,}811 \text{ tons, or}$$

15622 lbs.

If one-quarter of the wall were used up for openings, slots, flues, etc., the load on the balance would be 8 tons per running foot, which is still safe, according to our formula.

At the fifth-story level the load would be:

Load above seventh floor	=	11960
Wall	= 28.2.112 =	6272
Wind	= 28.30 =	840
Sixth and seventh floors	= 2.13.300 =	7800
Total	=	26872 lbs. or 13½ tons.

The safe load on a 24″ wall, 12 feet high, from formula (63) is:

$$W = \frac{2.200}{14 + 0{,}552.\frac{12.12}{2.2}} = \frac{400}{14 + 0{,}552.36} = 11{,}809 \text{ tons,}$$

or 23618 lbs.

GLOSSARY OF SYMBOLS.—The following letters, *in all cases*, will be found to express the same meaning, *unless distinctly otherwise stated*, viz.:—

- a = *area*, in square inches.
- b = *breadth*, in inches.
- c = constant for *ultimate resistance to compression*, in pounds, per square inch.
- d = *depth*, in inches.
- e = constant for *modulus of elasticity*, in pounds-inch, that is, pounds per square inch.
- f = *factor-of-safety*.
- g = constant for *ultimate resistance to shearing*, per square inch, across the grain.
- $g_{\prime}$ = constant for *ultimate resistance to shearing*, per square inch, lengthwise of the grain.
- h = *height*, in inches.
- i = *moment of inertia*, in inches. [See Table I.]
- k = *ultimate modulus of rupture*, in pounds, per square inch.
- l = *length*, in inches.
- m = *moment or bending moment*, in pounds-inch.
- n = *constant* in Rankine's formula for compression of long pillars. [See Table I.]
- o = the *centre*.
- p = the *amount* of the *left-hand re-action* (or support) of beams, in pounds.
- q = the *amount* of the *right-hand re-action* (or support) of beams, in pounds.
- r = *moment of resistance*, in inches. [See Table I.]
- s = *strain*, in pounds.
- t = constant for *ultimate resistance to tension*, in pounds, per square inch.
- u = *uniform load*, in pounds.
- v = *stress*, in pounds.
- w = *load at centre*, in pounds.
- x, y and z signify *unknown quantities*, either in pounds or inches.
- δ = *total deflection*, in inches.
- ρ^2 = *square of the radius of gyration*, in inches. [See Table I.]
- 𝔡 = *diameter*, in inches.
- 𝔯 = *radius*, in inches.
- π = 3.14159, or, say, 3.1-7 signifies the *ratio of the circumference and diameter of a circle.*

If there are more than one of each kind, the second, third, etc., are indicated with the Roman numerals, as, for instance, a, $a_{\prime}$, $a_{\prime\prime}$, $a_{\prime\prime\prime}$, etc., or b, $b_{\prime}$, $b_{\prime\prime}$, $b_{\prime\prime\prime}$, etc.

In taking moments, or bending moments, strains, stresses, etc., to signify at what point they are taken, the letter signifying that point is added, as, for instance:—

- m = moment or bending moment at *centre*.
- m_A = " " " *point A*.
- m_B = " " " *point B*.
- m_X = " " " *point X*.
- s = strain at *centre*.
- s_B = " *point B*.
- s_X = " *point X*.
- v = stress at *centre*.
- v_D = " *point D*.
- v_X = " *point X*.
- w = load at *centre*.
- w_A = " *point A*.

This is about 10 per cent less than the load, and can be passed as safe, but if there were many flues, openings, etc., in wall, it should be thickened.

At the second-story level the load would be:

Load above fifth floor		=	26872
Wall	= 42. $2\frac{1}{3}$.112	=	10976
Wind	= 42. 30	=	1260
Third, fourth and fifth floors	= 3.13.300	=	11700
Total		=	50808, or

25 tons.

The safe-load on a 28″ wall, 12 feet high, from formula (63) is:

$$W = \frac{2\frac{1}{3}.200}{14 + 0{,}552.\frac{12.12}{2\frac{1}{3}.2\frac{1}{3}}} = \frac{467}{14 + 0{,}552.26{,}45} = 16{,}33 \text{ tons,}$$

or 32660 lbs.

Or, the wall would be dangerously weak at the second-floor level.

At the first-floor level the load would be:

Load above second floor		=	50808
Wall	= 14. $2\frac{2}{3}$.112	=	4181
Wind	= 14.30	=	420
Second floor	= 13.300	=	3900
Total		=	59309, or 29½ tons.

The safe-load on a 32″ wall, 12 feet high, from formula (63) is:

$$W = \frac{2\frac{2}{3}.200}{14 + 0{,}552.\frac{12.12}{2\frac{2}{3}.2\frac{2}{3}}} = \frac{533}{14 + 0{,}552.20{,}25} = 21{,}169 \text{ tons, or 42338 lbs.}$$

The wall would, therefore, be weak at this point, too.

Now while the conditions we have assumed, an eight-story warehouse with all floors heavily loaded, would be very unusual, it answers to show how impossible it is to cover every case by a law, not based on the conditions of load, etc. In reality the arrangements of walls, as required by the law, are foolish. Unnecessary weight is piled on top of the wall by making the top 20″ thick, which wall has nothing to do but to carry the roof. (If the span of beams were increased to 31 feet or more the law compels this top wall to be 24″ thick, if 41 feet, it would have to be 28″ thick, an evident waste of material.) It would be much better to make the top walls lighter, and add to the bottom; in this case, the writer would suggest that the eighth story be 12″; the seventh story 16″; the sixth story, 20″; the fifth story, 24″: the fourth story, 28″; the third story, 32″; the second story, 36″, and the first story 40″, see Figure 90.

This would represent *but* $4\frac{2}{3}$ cubic feet of additional brickwork for every running foot of wall; or, if we make the first-story wall 36″ too, as hereafter suggested, the amount of material would be exactly the same as required by the law, and yet the wall would be much better proportioned and stronger as a whole. For we should find (for L = 12 feet),

Actual load at eighth-floor level,	3832
Safe load on a 12″ wall from Formula (62)	4298
Actual load at seventh-floor level,	10243
Safe load on a 16″ wall from Formula (62)	9135
Actual load at sixth-floor level,	17176
Safe load on a 20″ wall from Formula (62)	15729
Actual load at fifth-floor level,	24632
Safe load on a 24″ wall from Formula (62)	23750
Actual load at fourth-floor level,	32611
Safe load on a 28″ wall from Formula (62)	32825
Actual load at third-floor level,	41112
Safe load on a 32″ wall from Formula (62)	42638
Actual load at second-floor level,	50136
Safe load on a 36″ wall from Formula (62)	52902
Actual load at first-floor level,	59683
Safe load on a 40″ wall from Formula (62)	63492

The first-story wall could safely be made 36″ if the brickwork is good, and there are not many flues, etc., in walls, for then we could use $\left(\frac{c}{f}\right) = 250$, which would give a safe load on a 36″ wall = 65127 lbs., or more than enough.

The above table shows how very closely the Formula (62) would agree with a practical and common-sense arrangement of exactly the same amount of material, as required by the law.

Thrust of barrels. Now, if the upper floor were laden with barrels, there might be some danger of these thrusting out the wall. We will suppose an extreme case, four layers of flour barrels packed against the wall, leaving a 5-foot aisle in the centre. We should have 20 barrels in each row (Fig. 91), weighing in all 20.196 = 3920 lbs. These could not well be placed closer than 3 feet from end to end, or, say, 1307 lbs., per running foot of wall; of this amount only one-half will thrust against wall, or, say, 650 pounds.

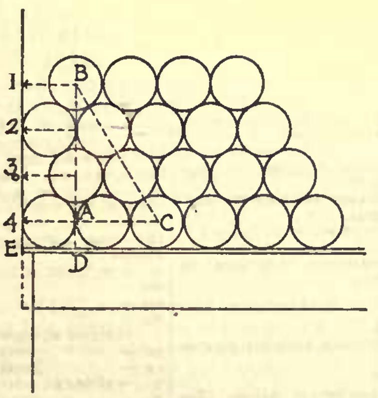


Fig. 91.

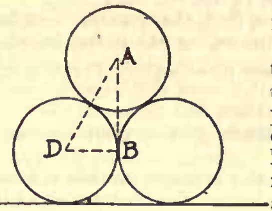


Fig. 92.

The radius of the barrel is about 20″.

If Figure 92 represents three of the barrels, and we make A B = $w_1 = \frac{1}{2}$ the load of the flour barrels, per running foot of walls, it is evident that D B will represent the horizontal thrust on wall, per running foot. As D B is the radius, and as we know that A D = 2 D B or = 2 radii, we can easily find A B, for:

$$A D^2 - D B^2 = A B^2 \text{ or } 4.\ D B^2 - D B^2 = w_1^2 \text{ or}$$

$$D B^2 = \frac{w_1^2}{3} \text{ or } D B = \frac{w_1}{\sqrt{3}} = \frac{w_1}{1{,}73} = 0{,}578.w_1$$

Or, $h = 0{,}578.\ w_1$ (64)

Where h = the horizontal thrust, in lbs., against each running foot of wall, w_1 = one-half the total load, in lbs., of barrels coming on one foot of floor in width, and half the span.

In our case we should have:

$$h = 0{,}578.650 = 375 \text{ lbs.}$$

Now, to find the height at which this thrust would be applied, we see, from Figure 91, that at point 1 the thrust would be from one line of barrels; at point 2, from two lines; at point 3, from three lines, etc.; therefore, the average thrust will be at the centre of gravity of the triangle A B C, this we know would be at one-third the height A B from its base A C.

Now B C is equal to $6r$ or six radii of the barrels; further

$A C = 3r$, therefore:

$$A B^2 = 36.r^2 - 9r^2 = 25.r^2, \text{ and}$$

$$A B = 5r; \text{ therefore } \frac{AB}{3} = 1\tfrac{2}{3}r.$$

To this must be added the radius A D (below A) so that the central point of thrust, O in this case, would be above the beam a distance $y = 2\frac{2}{3}.r$.

Where y = the height, in inches, above floor at which the average thrust takes place.

Where r = radius of barrels in inches.

Our radius is 10″, therefore:

$$y = 26\tfrac{2}{3}''$$

Now, in Figure 93 let A B C D be the 12″ wall, A the floor level, G M the central axis of wall, and A O = $26\frac{2}{3}$; draw O G horizontally; make G H at any scale equal to the permanent load on A D, which, in this case, would be the former load less the wind and snow allowances on wall and roof, or

$$3832 - (16.30 + 13.30) = 2962, \text{ or,}$$

say 3000 lbs.

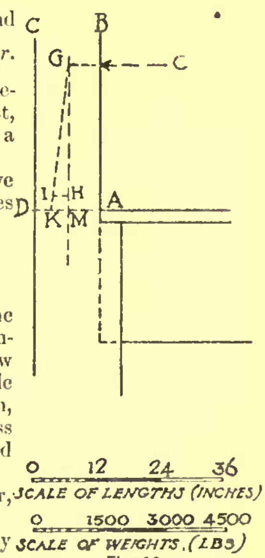


Fig. 93.

Therefore, make G H = 3000 lbs., at any scale; draw H I = h = 375 lbs., at same scale, and draw and prolong G I till it intersects D A at K.

The pressure at K will be

$$p = G I = 3023.$$

We find the distance M K measures

$$M K = x = 3\tfrac{1}{3}''.$$

Therefore, from formula (44) the stress at D will be:

$$v = \frac{3023}{144} + 6.\frac{3\frac{1}{3}.3023}{12.144} = +56 \text{ lbs. (or compression).}$$

While at A the stress would be, from formula (45):

$$v = \frac{3023}{144} - 6.\frac{3\frac{1}{3}.3023}{12.144} = -14 \text{ lbs. (or tension), so that}$$

the wall would be safe.

The writer has given this example so fully because, in a recent case, where an old building fell in New York, it was claimed that the walls had been thrust outwardly by flour barrels piled against them.

Narrow Piers. Where piers between openings are narrower than they are thick, calculate them, as for isolated piers, using for d (in place of thickness of wall) the width of pier between openings; and in place of L the height of opening. The load on the pier will consist, besides its own weight, of all walls, girders, floors, etc., coming on the wall above, from centre to centre of openings.

Wind-pressure. To calculate wind-pressure, assume it to be normal to the wall, then if A B C D, Figure 94, be the section of the whole wall above ground (there being no beams or braces against wall).

Make O D = $\frac{1}{2}$. A D = $\frac{L}{2}$; draw G H, the vertical neutral axis of the whole mass of wall, make G H, at any convenient scale, equal to the whole weight of wall; draw H I horizontally equal to the total amount of wind-pressure.

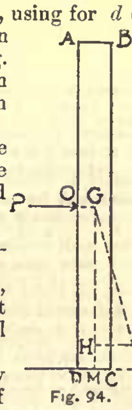


Fig. 94.

This wind-pressure on vertical surfaces is usually assumed as being equal to 30 lbs. per square foot of the surface, provided the surface is flat and normal, that is, at right

angles to the wind. If the wind strikes the surface at an angle of 45° the pressure can be assumed at 15 lbs. per foot.

It will readily be seen, therefore, that the greatest danger from wind, to rectangular, or square towers, or chimneys, is when the wind strikes at right angles to the widest side, and not at right angles to the diagonal. In the latter case the exposed surface is larger, but the pressure is much smaller, and then, too, the resistance of such a structure diagonally is much greater than directly across its smaller side.

In circular structures multiply the average outside diameter by the height, to obtain the area, and assume the pressure at 15 lbs. per square foot. In the examples already given we have used 15 lbs., where the building was low, or where the allowance was made on all sides at once. Where the wall was high and supposed to be normal to wind we used 30 lbs. Referring again to Figure 94, continue by drawing G I, and prolonging it till it intersects D C, or its prolongation at K. Use formulæ (44) and (45) to calculate the actual pressure on the wall at D C, remembering that, $x = $ M K; where M the centre of D C, also that,

$p = $ G I; measured at same scale as G H.

Remember to use and measure everything uniformly, that is, all feet and tons, or else all inches and pounds. The wind-pressure on an isolated chimney or tower is calculated similarly, except that the neutral axis is central between the walls, instead of being on the wall itself; the following example will fully illustrate this.

Example.

Wind-pressure on Chimney. *Is the chimney, Figure 87, safe against wind-pressure?*

We need examine the joints A and E only, for if these are safe the intermediate ones certainly will be safe too, where the thickening of walls is so symmetrical as it is here.

The load on A we know is 47 tons, while that on E is 657 tons.

Now the wind-pressure down to A is:

$$P_a = 10.30.15 = 4500 \text{ lbs., or } = 2\tfrac{1}{4} \text{ tons.}$$

On base joint E, the wind-pressure is:

$$P = 12\tfrac{2}{3}.150.15 = 28500 \text{ lbs., or } = 14\tfrac{1}{4} \text{ tons.}$$

We can readily see that the wind can have no appreciable effect, but continue for the sake of illustration. Draw P_a horizontally at half the height of top part A till it intersects the central axis G_1; make G_1 H_1 at any convenient scale = 47 tons, the load of the top part; draw H_1 I_1 horizontally, and (at same scale) = $2\frac{1}{4}$ tons = the wind-pressure on top part; draw G_1 I_1; then will this represent the total pressure (from load and wind) at K_1 on joint A A_1.

Use Formula (44) to get the stress at A_1 where $x = K_1 M_1 = 9''$, or $\frac{3}{4}$ feet; and $p = G_1 I_1$, which we find scales but little over 47 tons; and Formula (45) for stress at A. For d the width of joint we have of course the diameter of base, or $10\frac{2}{3}$ feet. Therefore

$$\text{Stress at } A_1 = \frac{47}{39} + 6.\frac{47.\frac{3}{4}}{39.10\frac{2}{3}} = +\ 1{,}71 \text{ tons, per square}$$

foot, or $\frac{1{,}71.2000}{144} = +\ 24$ lbs. (compression), per square inch, and

stress at $A = \frac{47}{39} - 6.\frac{47.\frac{3}{4}}{39.10\frac{2}{3}} = +\ 0{,}7$ tons, per square foot, or

$\frac{0{,}7.2000}{144} = +\ 10$ lbs. (compression), per square inch.

To find the pressure on base E E_1; draw P G horizontally at half the whole height; make G H = 657 tons (or the whole load) and draw H I horizontally, and = $14\frac{1}{4}$ tons (or the whole wind-pressure). Draw G I and prolong till it intersects E E_1 at K. From formulæ (44) and (45) we get the stresses at E_1 and E: p being = G I = 658 tons; and $x = $ M K = 20″, or $1\frac{2}{3}$ feet. For d the width of base we have the total diameter, or 16 feet. Therefore stress at $E_1 =$ $\frac{658}{151} + 6.\frac{658.1\frac{2}{3}}{151.16} = +\ 7$ tons per square foot, or $\frac{7.2000}{144} = +97$ lbs. (compression), per square inch, and stress at $E = \frac{658}{151} - 6.\frac{658.1\frac{2}{3}}{151.16} =$ $+\ 1\frac{2}{3}$ tons (compression), per square foot, or $\frac{1\frac{2}{3}.2000}{144} = +\ 23$ lbs. (compression) per square inch.

There is, therefore, absolutely no danger from wind.

Strength of Corbels. Corbels carrying overhanging parts of the walls, etc., should be calculated in two ways, first, to see whether the corbel itself is strong enough. We consider the corbel as a lever, and use either Formula (25), (26) or (27); according to how the overhang is distributed on the corbel, usually it will be (25). Secondly, to avoid crushing the wall immediately under the corbel, or possible tipping of the wall. Where there is danger of the latter, long iron beams or stone-blocks must be used *on top* of the back or wall side of corbel, so as to bring the weight of more of the wall to bear on the back of corbel.

To avoid the former (crushing under corbel) find the neutral axis G H of the whole mass, above corbel, Figure 95; continue G H till it intersects A B at K, and use Formulæ (44) and (45).

If M be the centre of A B, then use $x = $ K M, and $p = $ weight of corbel and mass above; remembering to use and measure all parts alike, that is, either all tons and feet, or all pounds and inches.

Example.

Calculation of corbel. *A brick tower has pilasters 30″ wide, projecting 16″. On one side the tower is engaged and for reasons of planning the pilasters cannot be carried down, but must be supported on granite corbels at the main roof level, which is 36 feet below top of tower. The wall is 24″ under corbel, and averages from there to top 16″, offsets being on both sides, so that it is central over 24″ wall. What thickness should the granite corbel be?*

If we make the pilaster hollow, of 8″ walls, we will save weight on the corbel, though we lose the advantage of bonding into wall all way up. Still, we will make it hollow.



Fig. 95.

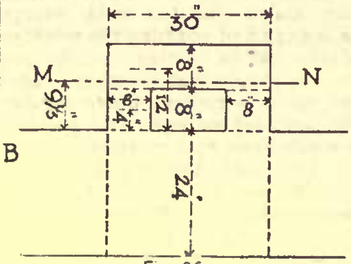


Fig. 96.

First, find the distance of neutral axis M–N (Figure 96), of pilaster from 24″ wall, which will give the central point of application of load on corbel. We use rule given in the first article, and have

$$x = \frac{8.30.12 + 8.8.4 + 8.8.4}{8.30 + 8.8 + 8.8} = 9\tfrac{1}{3}''$$

The weight of pilaster (overlooking corbel) will be 6624 lbs., or $3\frac{1}{3}$ tons.

Assuming that only 30″ in length of the wall will come on back part of corbel, the weight on this part would be 8640 lbs., or $4\frac{1}{3}$ tons.

The bending moment of 6624 lbs. at $9\frac{1}{3}''$ from support on a lever is (see Formula 27):

$$m = 6624.9\tfrac{1}{3} = 61824 \text{ (lbs. inch).}$$

From Formula (18) we know that:

$$\frac{m}{\left(\frac{k}{f}\right)} = r$$

From Table I, Section Number 3, we have:

$$r = \frac{b.d^2}{6} = \frac{30.d^2}{6} = 5.d^2$$

And from Table V, we have for average granite:

$$\left(\frac{k}{f}\right) = 180$$

Inserting these values in Formula (18) we have:

$$\frac{61824}{180} = 5.d^2, \text{ or } d^2 = \frac{61824}{900} = 68{,}7, \text{ therefore, } d = 8\tfrac{1}{3}''.$$

We should make the block 10″ deep, however, to work better with brickwork. This would give at the wall a shearing area = 10.30 = 300 square inches, or $\frac{6624}{300} = 22$ lbs., per square inch, which granite will certainly stand; still, it would be better to corbel out brickwork under granite, which will materially stiffen and strengthen the block.

Pressure under corbel. To find the crushing strain on brick wall under corbel, find the central axis of both loads by same rule as we find centre of gravity; that is, its distance A K from rear of wall will be (Figure 97)

$$\frac{4\frac{1}{3}.12 + 3\frac{1}{3}.33\frac{1}{3}}{4\frac{1}{3} + 3\frac{1}{3}} = 22\tfrac{1}{7}''$$

or, say, 22″, the pressure at this point will, of course, be = $4\frac{1}{3} + 3\frac{1}{3} = 7\frac{2}{3}$ tons, or $p =$ 15340 lbs.

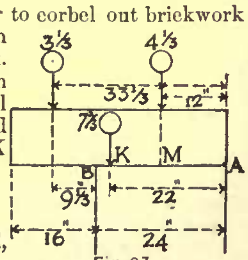


Fig. 97.

The area will be = 24.30 = 720 square inches, while K M measures 10″; we have, then, from Formulæ (44) and (45) stress at

$$B = \frac{15340}{720} + 6.\frac{15340.10}{720.24} = +\ 74 \text{ lbs. (compression), and}$$

stress at $A = \frac{15340}{720} - 6.\frac{15340.10}{720.24} = -\ 31$ lbs. (tension).

There would seem to be, therefore, some tendency to tipping, still we can pass it as safe, particularly as much more than 30″ of the wall will bear on the rear of corbel.

If the wind could play against inside wall of tower, it might help to upset the corbel, but as this is impossible, its only effect could be *against* the pilaster, which would materially help the corbel against tipping.

Louis DeCoppet Berg.

[To be continued.]

A Garbage Destructor. —The garbage crematory at Wheeling, W. Va., is said to be completed, and to have stood the tests which have been applied to the satisfaction of the authorities. Pittsburgh, Penn., is also endeavoring to solve the difficult problem of the disposal of garbage, and has advertised for bids to construct furnaces. We regret to learn that the Milwaukee, Wis., authorities, have decided to remove the garbage of that city to the country, and there bury it in the ground. Such a method of disposal is, at the best, unsanitary, and can be but a temporary relief.—*Science.*

COMMUNICATIONS

THE PRACTICAL VALUE OF GROUTING.

NEW YORK, N. Y., June 10th, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT:—

Dear Sirs, — It is quite evident, as Mr. Berg confesses, that he is unable to answer my protest against his unsupported assertion that "practically, grouting makes the *best* work except in freezing weather." I had no intention of omitting the word *except* from his sentence. The exception has no bearing upon the question at issue. Colonel Sedden says very clearly that grouting is advisable in some cases, as a makeshift, as an expedient where regular mortar-work has been improperly done, but no one could possibly construe his remarks to mean or imply even that grouting makes the *best* work. Clearly the issue is, "Practically does grouting make the *best* work that can be done?" My position is this: 1st. Grouting is to be regarded as an expedient only. 2d. Where it is possible to use neat cement as a mortar, grouting is never equal to the best cement-mortar for any kind of work whatever. 3d. In the preparation of grouting the smaller the amount of water used the stronger the grout will become. 4th. Grouting should never be made of any materials but neat cement.

In support of the last two declarations I cite the concurrent testimony of Mr. W. R. Kinipple, M. I. C. E., who says, (see "*Proceedings of Inst. Civ. Eng'rs., Vol.* 87, *page* 183"): "Mixtures of cement and sand for grouting purposes had sometimes been adopted by engineers, but it was *most injudicious* to use such, as when reduced to the form of grout, especially thin grout, the materials, instead of remaining as a mixture, separated into layers, thus: 1st, or bottom layer, sand; 2d, coarsely-ground particles of cement; 3d, cement, with setting properties greatly reduced; 4th, lime, etc., in a creamy condition, separated from the cement through stirring in making up the grout. *Failure was certain* to follow the use of a mixture of sand and cement for grouting purposes."

This conclusion practically condemns grouting, for, by the term as generally understood, grouting means a fluid mortar of cement and sand. Mr. Kinipple employed a paste or very thick grout of neat cement, and it had proved successful as an expedient, but nowhere did he indicate that he would have used it in preference to neat cement-mortar had it been possible for him to overcome the mechanical difficulties in using the neat cement-mortar in the kind of work he had to do.

Mr. William E. Worthen, C. E., does not approve of the use of grouting, for he says, "Some lay the rubble dry and fill in with cement-grout or cement-mortar made liquid to flow into the interstices, but the sand is apt to separate and get to the bottom of the course." See "*Appleton's Cyclopedia of Technical Drawing,*" page 189.

In support of my first and second declaration I cite two authorities well known to American and European engineering circles, viz.: 1st. The gentleman who is now Consulting Engineer to the New Croton Aqueduct Commission, and who was for seven years Resident Engineer to the Additional Water-Supply for the city of Boston, says: "It is absurd to suppose that grouting makes the *best* work practically; it is only to be used as a makeshift." And more than that, he is of the opinion that grouting should never be used for masonry that is under water-pressure. 2d. Mr. Joseph P. Davis, late Chief Engineer of the Boston Additional Water-Supply, and at one time Consulting Engineer to the New Croton Aqueduct Commission, at its inception, and by whose advice and counsel the specifications were prepared for the new aqueduct, a work involving the expenditure of over $14,000,000, and the most colossal work of masonry ever undertaken in this country, distinctly states in all the various books of specifications, without even one exception, that "*no grouting of joints will be allowed.*" In order that there can be no possible misunderstanding upon this point, I quote the passage, section and paragraph in full, viz.: "The stones must be well bedded in the mortar and care must be taken to fill solid all the joints. NO GROUTING OF JOINTS WILL BE ALLOWED." See "*Masonry Specifications for the* 135*th Street Gate-House, New York,* section 15, paragraph 45, page 16.

Is it not now in order for Mr. Berg to explain why grouting is so emphatically *condemned* in the greatest public work ever undertaken in America? I am unable to find any authority either among American, English, German or French engineers who will admit that grouting makes the *best* work practically; the best that can be said of it is that it is a makeshift only, and that many of our best engineers condemn its use, but I forbear to quote any more authorities, for they are without number. Mr. Berg says that the other authorities I quote all but prove his statement (which, by the way, he has been careful to quote incorrectly). He did not say "that grouting practically is good," but "practically it makes the *best* work," see *American Architect,* No. 593, page 224. There is a vast difference between merely *good* and *best.* I suppose he refers the alleged confirmation particularly to "*Rivington's Notes on Building Construction,*" Vol. 3, page 197, which says just as I quoted: "Grout is deficient in strength and *should not be used* where it can be avoided." It does not regard grout as even *merely good.* How could language be more condemnatory than to say it is deficient in strength?

Finally, if Mr. Berg expects his articles on "Safe Building" to be of any value to or carry any weight with professional men, he must cite his authorities for every statement that rests upon debatable ground. His citations of authorities so far have been conspicuous by their absence. In his Table No. 5, I am unable to find any tests of the strength of grouted masonry, but if grouting makes such alleged superior work, why was it omitted? Such an omission is highly inconsistent. Surely there was no lack of examples; even the writer's alleged limited knowledge is able to supply a few. As Mr. Berg has failed to substantiate his statement by citing any authority that agreed with him, and then succeeded in quoting himself incorrectly by way of explaining his untenable position, I find that I must still maintain my unequivocal exception to the statement that "Practically grouting makes the *best* work."

I trust you will do me the honor to publish my reply in full.

Yours very truly, C. POWELL KARR, C. E.

NEW YORK, June 16, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT:—

Dear Sirs, — In the last issue of your valuable paper, I notice a controversy between Messrs. L. DeCoppet Berg and C. Powell Karr as to the fact whether "grouting masonry, except in freezing weather, makes the best work *practically.*" Having been connected for a number of years with a concern which has large building interests in New York and vicinity, it occurred to me that it would not be considered presumtuous by either of the above-mentioned gentlemen if I should state its experience, which embraces a period of forty years.

In the first place we contend, from practical observation and test, that masonry CAREFULLY grouted when the temperature is not lower than 40° Fahrenheit, will give the most efficient result. A forcible illustration of this occurred on a store building which we erected, wherein some of the piers had been grouted and others laid up without this method. Two years after completion of the work, a fire destroyed it and some of the piers were removed. Those that had not been grouted were removed with comparative ease, but the grouted piers had to be wedged at the bottom and were thrown bodily to the ground, remaining intact, though having fallen a number of feet in height. They were then broken apart by means of wedges and sledge hammers and not one brick could be used again, the break almost invariably occurring through the brick, not at the joint. At various times we have cut openings through grouted walls and others not so treated, and, without exception, the most time and labor was spent where the masonry had been grouted. The union between the brick and mortar in properly grouted work is so perfect that they become one mass, and, as it were, one stone. Perhaps this becomes more evident when it is known that grouted work takes fully one-fifth more mortar. It is true that if grouting is improperly done, the fears of Mr. Karr would be realized, but with the proper kinds and quantities of materials and careful workmanship, no masonry can compete with a like piece of grouted work.

To show that many of the most prominent architects and builders have the same opinion, I append a list of a number of the heaviest and best-known structures in this city, which to my certain knowledge have grouted walls, viz.: Metropolitan Opera House, Produce and Cotton Exchanges, Mortimer and Mills Buildings, Equitable and Mutual Life Insurance Buildings, Standard Oil Building, Astor Building, Schermerhorn Building, Gallatin Bank Building, Seaman's Savings Bank, Central Trust Company Building, Seventh Regiment Armory, Eagle Fire Insurance, Gorham Building, Steinway Hall, The Eden Musée, The Dakota Apartment Building, several tanks of the Consolidated Gas Company, The Navarro Buildings, Manhattan Bank Building, Lenox and Astor Libraries, the Presbyterian, German, St. Vincent and Woman's Hospitals, etc. Furthermore, one of the greatest pieces of masonry in the world, the Mersey Docks and Warehouses at Liverpool, England, have been grouted throughout.

Respectfully yours, OTTO M. EIDLITZ, C. E.

RECTOR PIERSON, FIRST PRESIDENT OF YALE COLLEGE.

EVERGREEN HOME, ONARGA, IROQUOIS CO., ILL., June 10, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT:—

Dear Sirs, — In the monthly number of the *American Architect* of June 4th, under the head of "Early Settler Memorials," I find statements in relation to Rector Pierson, the first President of Yale College, that are quite remarkable as specimens of historical inaccuracies. The writer states that "The old red sandstone tablet erected to the Rector in the cemetery at Clinton, Conn., bears the following inscription:

'In memory of Worshipful Abraham Pierson, Esq.,
Who died Jan. 8, 1752, in his 79th year.'"

The notable mistake or inaccuracy here is found in the fact that this old red sandstone tablet in the cemetery at Clinton was erected in memory of Abraham Pierson, Esq., an old colonial magistrate, and the eldest of the three sons of the Rector, and *not* to the Rector himself, as represented in the article referred to.

Mistake No. 2. Abraham Pierson, the Rector, died in 1707, at

the age of sixty-six, and *not* "in 1752, in his 79th year," as represented in the aforesaid article.

Mistake No. 3. The aforesaid article represents Gen. William A. Pierson of Windsor, Conn., as being the only living male descendant of Rector Pierson, the first President of Yale. The fact of the matter is that Gen. William S. Pierson was, when alive, one of the many hundred of now living male descendants of Rector Pierson.

Yours truly,
William P. Pierson.

NOTES AND CLIPPINGS

Scandanavian Engineers.—A gentleman who has given the matter careful attention predicts that the civil engineering of the Northwest will soon be done to a great extent by young Scandinavians, graduates from the polytechnic schools of Europe. He bases this opinion upon the fact that there are no less than 30 Scandinavian engineers employed in the railway offices and engineering departments of St. Paul and Minneapolis alone, nearly all of them men of fine attainments and thoroughly versed in their chosen profession. Many important public improvements in both cities have been completed under the supervision of this class of engineers.—*St. Paul Pioneer Press.*

One Safe Theatre.—People who want to enjoy a play in peace of mind will have to go to Belgium. The new Flemish theatre in Brussels promises, when completed, to afford every guarantee of safety which the most timid play-goer could desire. The materials employed in its construction are stone and iron; and, though it will be impossible to dispense with woodwork altogether on the stage, all the timber used will first be rendered absolutely incombustible. Two broad flights of stairs, one at each side of the main entrance, lead to the grand circle and the *foyer*, which are on the first floor. The three upper tiers have each its own independent stairway opening directly on the street. The building is provided with twelve different outlets; nine for the egress of the spectators and three for that of the *personnel*. But the most original feature in the construction is the system of external balconies or outer-galleries, corresponding to those in the interior of the building, with which they communicate by no fewer than a hundred different doors—twenty-five to each tier. These balconies are further connected with each other by iron stairs of good width and easy descent, and the lowest of the four is capacious enough to give standing-room to the entire audience.—*St. James' Gazette.*

The Rubbish Heaps of Naucratis.—Time, which has destroyed all that was splendid in the temples of Naucratis, the marble pillars, the cultus-statues, the dedicated vessels of gold and silver, has made some amends by preserving to us their rubbish heaps. It was the custom of the city that Greeks who entered Egypt by that way should dedicate to the patron deity, under whose protection they voyaged, a statuette or vessel of pottery in memory of a safe journey. On the object so dedicated they would inscribe the name of the donor. And as from time to time the temples became too full of these pious offerings, the temple officers would dig a trench and bury all that they judged to be superfluous, breaking them up for economy of space. Out of such trenches Mr. Petrie and Mr. Gardner have extracted thousands of fragments of pottery painted with figures or inscribed with dedicatory formulæ, besides many statuettes, mostly fragmentary also. To build up these fragments into vases, nearly or partly complete, is a laborious task, which is now in progress, and of which the results can scarcely fail to be valuable. We shall acquire a long series of inscriptions for the epigraphist, and for the archæologist a quantity of vases which can be dated by means of the inscriptions which they bear. And we shall acquire a sort of visitors' album, a record of the Greeks who went to Egypt, from the foundation of the city under Psammitichus down to the Persian conquest, when these dedicatory customs seem to have been discontinued. Mr. Gardner has already made public one name of no ordinary interest, which he has deciphered, that of Rhœcus, probably the same sculptor Rhœcus who was in antiquity spoken of as having worked in the Egyptian style, and who was, at the same time, with his son Theodorus, one of the originators of the production in Greece of statues of divinities. In another case we seem to find the name of Sappho, whose brother, if not herself, is known to have journeyed to Naucratis. On one large vessel we read the name of Phanes, the son of Glaucus, whom Mr. Gardner can scarcely be wrong in identifying with the Greek captain of mercenaries who led Cambyses into Egypt.—*The Quarterly Review.*

Checking Jerry-Building in Rome.—A novel strike is threatened in Rome. The construction of houses in the new part of the city, and especially in those sections which have been demolished and rebuilt, has been carried on under regulations so bad, or so easily evaded, that the new quarter is the most disgraceful appendix to a great city to be found in all Europe. The houses are huge, tasteless, stucco palaces, so high as to shut off the sunlight, necessary above all things in Rome, from the lower stories of the houses opposite. They are ill-constructed, so that, in more than one case they have fallen into the spaces in front of them, and flimsy and ill-contrived, so that one hears the common domestic sounds from apartment to apartment and from story to story. There is the least possible attention to the sanitary requisites which decency would permit—in short, the quarter is a huge congeries of "jerry" dwellings, built on speculation, in which no person who regards personal comfort would continue to reside except on compulsion, and it is in general, æsthetically and economically, a disgrace to Rome. To this condemnation there are but few exceptions, so that the new Rome is compromising the character and injuring the future prosperity of the capital. The municipality, becoming finally awake to the state of affairs, has enacted new and more rigorous regulations for future construction, which will in part prevent such monstrous failures as some of those now visible. The contractors and speculators have called a general meeting to protest against this interference with the acquired rights and interests of the building trade. They threaten disorders among the workmen, and decline all responsibility for them when they arise owing to the stoppage of the works. Building has been a huge speculation here for years past. The subject is of incalculable importance to the future of Rome.—*London Times.*

TRADE SURVEYS

One of the many favorable indications of healthful activity is that nearly all of the railroad companies of the United States are making or preparing to make extensive purchases of material, motive-power, land and rolling-stock. Materials, such as iron, steel, spikes, bolts, lumber, stone, are needed to extend contemplated mileage. Motive-power is needed in shops and on the roads. Repairing requirements are very much larger than a year ago. The locomotive-makers and makers of boilers, engines, presses, lathes, etc., have much business in hand. Many railroad companies are acquiring additional land for future shop needs and for various purposes. Large orders have been given out during the past two weeks for rolling-stock and for cars suitable for iron; steel, ore, coal, lumber, oil, etc. The Western car-builders have been asking Eastern builders to divide their work and help them out. Eastern builders have been offering work to Western car-wheel and car-axle makers. Merchant-steel and Bessemer-steel makers have only recently experienced a slacking in demand. Taking out the enormous railroad requirements, the phenomenal activity of all markets would disappear, prices would decline, and the snap that characterizes everything in trade would be wanting. Railroad earnings are over seven-and-one-half per cent this year in excess of last year to this date. The volume of bank-cleanings this year to date are fifteen per cent in excess of last year. Real estate has advanced in value. House-building operations have increased. Demands for all kinds of material is stronger, and the autumn and winter prospects continue favorable. The increase of money within a year is equal to $70,000,000. Had it been double this, damaging speculation might have followed. The supply of money will probably increase, and only the least possible amount will be retained in idleness. Traffic and exchanges are lighter at the turn of the half year than earlier and later. An unusually large amount of business is hanging fire in iron, lumber, coal, cotton, woollen stocks, and in contracts for the requirements of the last half of the year. Building interests thus far have been protected against fluctuations in values. An attempt will be made next month, it is said, in the Northwest, to advance lumber $1 per M. Eastern markets have been stocked fully, but the Western markets will continue to absorb Michigan lumber freely. The shipments of dry lumber during the month of June exceeded all previous records, and certainly all anticipations of manufacturers and shippers. No decline in lumber prices is probable. Southern shipments are large, and the rail-traffic in lumber is increasing. The interior demand, especially from the smaller manufacturing towns, continues very large. The anthracite-coal trade is 1,500,000 tons in round numbers, ahead of the production at this date last year. The bituminous output, if properly tabulated, would show a relatively greater increase. The increase of two Pennsylvania coal fields, Clearfield and Broad Top, and one Virginia field, shows an increase of 1,000,000 tons over the production at this time last year. The Western coal fields are doing well, and in the far West mines will be opened for railroad, manufacturing and domestic supplies at numerous points. Recorded railway-construction is put at 1688 miles this year as against 1271 same time last year, but these figures do not include a great deal of side-tracking and repairing which, if reported, would show twice that amount of actual track-laying. The rail-mills have contracts for the delivery of 800,000 tons this year, and of an immense amount of winter bridge work. The iron-workers have made demands for higher wages, which will strain the generosity of employers to grant. The coke-workers at this hour are still stubborn. New sources of supply will be in operation as early as October, but Connelsville will always command the market.

The half year has been a busy one among architects and builders. A summary of new building operations for the past month shows that the average is being preserved. The last half of the year will be even more active. Matters are unsettled at Chicago, and in some lines farther west strikes have occurred, but no very serious results are now anticipated. Labor will make the best of its opportunities for the rest of the year. Employers have exhibited the necessary determination to contest unjust demands, and a less arbitrary spirit among workmen is the result. Labor leaders admit that there is a growing conservatism, or, as they put it, lethargy among a large percentage of the membership. Returns from twenty-six cities, large and small, show an increase of nearly twenty-five per cent in amount expended for the first five months of this year as against same time last year, and an increase of forty per cent in real estate transactions. The great rush in Western real estate is over for the present. Speculators have taken counsel with experience, and are waiting for progress in business. The country will not follow blindly in the lead of wild speculators. The greatest industrial activity will be developed in the Mississippi valley, and Chicago will control the greatest distribution which it will bring about. Small manufacturing concerns are multiplying West and South, and far Western markets are being built up. The Eastern jobbing centres are fully prepared for the early opening of the autumn trade. Machinery orders continue to multiply, when but a minimum of business is to be expected. The midsummer season will be more active than usual. Hardware manufacturers have had a busy June month. Electricians and electrical supply-houses are very busy, and not a few are working at nights. The orders for such products as nails, chains, rods, paints, pipes, tools, and a score of other minor articles, are unusually large. The stove-makers have large orders on hand, and have distributed the bulk of last winter's castings. Foundry work is active, and foundry irons are scarce and dear. Rolling and plate mills are slack. Bridge mills and works are overcrowded. Textile mills on cotton goods are quite busy, but on novel products, slack. Paper mills everywhere, especially those on book-paper, are very busy. The publishing-interests and press-room managers are unusually busy by way of preparing printed matter for the fall trade. Agricultural implement-makers are pushing a little cautiously, except where manufacturers have an assured trade. The overdoing limit has not been reached, in fact, is not in sight—yet prudence is necessary to prevent a clogging of the channels of production. The attempted stock speculations and cornering of staples exhibit the strength of the markets, the abundance of supplies, and the quiet confidence of the people in their ability to control their own interests against speculators.

THE AMERICAN ARCHITECT AND BUILDING NEWS.

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MR. HUBERT HERKOMER, now Professor in the University of Oxford, and the head of a very successful school of painting, is now building himself a wonderful house, which is described in the *British Architect* by Mr. E. C. Robins, who has recently visited it. Most of our readers know that the house was designed by the late H. H. Richardson, although Mr. Robins speaks of its author as simply "an American architect." The accounts of the way in which Professor Herkomer came to apply to Mr. Richardson for the design of the building vary. The English theory is, we believe, that the great artist, being on the most friendly terms with all the principal architects in his own country, felt that if he selected one of them to serve him professionally he would alienate the others; and, to avoid this misfortune, he concluded to offend all of them equally, but less seriously, by getting his architecture three thousand miles away. The American version of the story is that Mr. Herkomer appeared one day at Mr. Richardson's house and informed him that he had come to paint his portrait. Mr. Richardson, who knew the enormous prices paid for his visitor's work, protested that he had never thought of having his picture painted by so distinguished an artist, and that he could not possibly afford such a luxury. Mr. Herkomer answered that he had wished for some time to have a design for a house from Mr. Richardson, and had now come three thousand miles to get it, and wanted to paint Mr. Richardson's portrait to pay for it. This proposition simplified the matter, and terms were soon arranged, by which the Brookline architect took the plans, already laid out by the painter's talented wife, and worked them into available shape. The problem was one such as Mr. Richardson particularly delighted in — an irregular plan, composed of all sorts of studios, no two on the same level, with connecting corridors and galleries of various shapes and sizes, covered by high, simple roofs with huge dormers, giving his fancy ample room for the picturesque effect which he loved so passionately.

WHEN the working-drawings were done, and paid for by that striking portrait which we know so well, Mr. Herkomer carried them back to England and began putting them in execution, but with a variation, quite characteristic of so true an artist, from the ordinary methods. Instead of making a contract with a fashionable upholsterer for the finishing and decoration, with orders to have this room done in the Louis Seize style, the next in Moorish, and the connecting corridor in the Norwegian Romanesque, and to have the whole completely finished and delivered within three months from date of contract, he set himself at work to design panellings, carving, metal-work, coloring, hangings, and so on. A good artist is usually very much of an architect, just as a good architect is very much of an artist, and even the sober and thoroughly-trained Mr. Robins speaks continually, in describing his visit, of the "wonderful panelling," the "superb carving," the "glorious copper foliated railing," and the "inimitable" andirons and brackets which he saw, not only designed, but in many cases executed by the artist's own hand. More than this, whenever possible, Mr. Herkomer has endeavored to have the work that he could not do himself executed by his own relatives, many of whom are persons of great talent. An uncle in America is now weaving some of the silk draperies, another uncle and his father are to do carving for him, and the work that cannot be made a souvenir of some loved hand is to be executed in little workshops close by, under the eye of the master. Of course, finishing in this way takes time, and Mr. Herkomer intends to spend ten years over it, but when it is done it will not contain, if he can avoid it, a single inch of dull, meaningless, stupid detail, of laborious ugliness, or cheap sham. Whatever materials are used are of the best and most solid kind. The rooms are mostly panelled in oak, the cupboards in the drawing-room have doors with panels of pierced and repoussé soft steel, and copper, wrought-iron and stone take the place of the flimsy wooden baluster-work which we use so freely. What with the material, the design, and the method of execution, Professor Herkomer's house is certainly one of the remarkable of modern times. It is said that the inexhaustible beauty of detail of the old German churches suggested to him his plan for making his house a sort of museum of artistic workmanship, but, much as we may delight in the productions of Adam Krafft or his friend, we must acknowledge that the nineteenth century furnishes us with greater resources of material than they had, and under such a master as Herkomer, the realization of his scheme might well mark an era in art.

LA REVUE INDUSTRIELLE, which shows a singular judgment in its selection of new inventions for description, gives an account of two, which, as it seems to us, are likely to become more familiar some time. One of these is a riveting-machine, for use either in the workshop or on the ground, which acts in a manner completely new, but presents, apparently, great economy, as well as facility of management. Most architects have seen the riveting of bridge and roof work, either by hand, with hammers and die, the process employing three and often four men, or by the hydraulic machine, a most effective instrument, but incapable of being moved very far from the stationary pump which supplies it. Unlike this tool, the new riveter, which should be known by the name of its makers, Varlet et Cie, can be carried to any point on a wheelbarrow, hung by a chain, or placed upon a rolling stand, in proper position for action, and at a moment's notice unhooked and carried off somewhere else. In substance, the Varlet riveter consists of two short levers, or jaws, the front end of each of which carries a die for forming a rivet-head, while the rear ends are connected by a toggle, or knee-joint. The fulcrums of the lever are about half way between the ends, and consist of pins passing through a strong casting. The back of this carries a large screw, which passes through a nut which forms the knee of the toggle-joint, and, continuing a little farther, ends in a wheel with handles, like a steering-wheel. By turning this wheel the nut is made to move forward or backward on the screw, bending or straightening the toggle-joint, and bringing the rear ends of the levers nearer together or farther apart, and correspondingly opening or shutting the jaws which form the front ends of the levers. From the well-known principles of the toggle-joint, it is evident that as the knee approaches a straight line an enormous pressure is exerted at the ends of the jaws, and it is calculated that a pressure of twenty pounds on the handles of the wheel will exert force enough for any sort of riveting. The whole affair, when used in the shop, is suspended from the roof-beams or travelling-carriages by a counter-balanced chain, so that it can be readily moved to any position, and the piece to be operated upon is set so that the rivets will be vertical when placed in the holes made for them. With hand-riveting this would be inconvenient, as the man who holds the stationary hammer against the head of the hot rivet would be compelled to stoop or lie under the piece; but with the new riveter many advantages are gained. The greatest of these is, perhaps, the opportunity which it affords for using short pieces of round iron in place of rivets with heads. The iron bar being first cut into the proper lengths, nothing is necessary but to heat these, and drop them into the holes as the machine advances. The lower jaw, as well as the upper, being formed with a die, the bar drops just

far enough to reach the bottom of the die, and is then, by the closing of the jaws, compressed equally at each end, the two heads being formed together, and the hot metal of the rivet being forced uniformly into the irregularities of the hole in which it is placed, so as to fill it completely. This, with punched rivet-holes, which are seldom perfectly true, is an important matter, as the rivet cannot then be bent or turned under any strain so as to force off the head. With long rivets put in by hand, the part which receives the hammering is generally expanded so as to fill the hole, but the portion next the head is not much affected, and often remains loose; so that the bar with both heads formed at once gives not only a cheaper but a better rivet than the ordinary kind. Where a long row of rivets is to be driven, a small carriage may be adjusted to run over it, carrying the riveter, so as to secure the greatest speed for the work; and a small hydraulic press, connected with a pump by a hose, is then used instead of the screw for moving the toggle-joints.

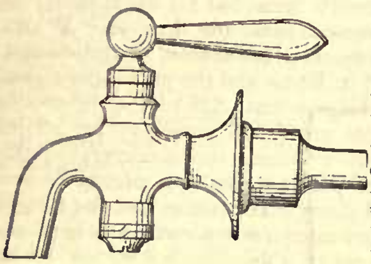
THE other invention is that of a new method for restoring the electric current in an arc-light. The greatest trouble in electric lighting of this kind has always been the difficulty of maintaining the arc. Notwithstanding the tremendous force of the current, it cannot jump through the air, even to a very small distance, and the only way in which the arc can usually be obtained is to bring the carbon poles in actual contact, and then, when the current is passing freely, separate them so as to display the dazzling arc formed by means of the electricity which then continues to pass across the interval. A slight obstacle to the current, or even a puff of wind, will often interrupt the arc, and it cannot be relighted in the air until the carbons are again brought in contact and separated as before. The various patents for arc-lights apply generally to details of different devices for producing this contact and subsequent separation of the carbons automatically, and the well-known flickering of arc-lights proceeds mostly from the automatic and instantaneous dropping of the upper carbon on the cessation of the current, and its retreat to its place as soon as it has touched the lower carbon and thus reëstablished the current. The abstraction of air from the space surrounding the carbons modifies greatly the behavior of the current. As soon as the resistance of the atmospheric non-conducting envelope is reduced beyond a certain point, the electricity, so to speak, bursts forth, and finds for itself a passage between the electrodes, and if anything near a vacuum is reached, the current pours freely between the electrodes, even though separated by several feet, filling the exhausted tube between them with a flame, usually of a blue or pink color, and far less brilliant than the ordinary electric arc in air. By gradually admitting air to the exhausted tube, however, the pale, diffused flame is reduced in dimensions and increased in brilliancy, until it reaches the usual form. M. Maneuvrier has taken advantage of this to arrange arc-lights in which the current passes between poles fixed in a glass globe hermetically sealed, except that a three-way cock serves to connect it with an air-pump or with the external atmosphere at pleasure. To light the lamp thus arranged, it is only necessary to connect the globe and the exhaust. As soon as the pressure of air in the globe is reduced to a certain point, the current begins to pass between the carbons in a bluish flame, and the atmosphere is then slowly admitted until the brilliant arc is produced. If the air is allowed to enter too rapidly, the arc is extinguished and the globe must be again exhausted, but with care the experiment may be successfully repeated as often as required.

THE *Builder*, which is becoming an authority on archæological matters, reviews a book by Professor Baldwin Brown, entitled, "*From Schola to Cathedral*," and intended to trace the development of Christian church architecture from a period anterior to that at which the increasing Christian congregations in Italy found it convenient to utilize for their services the disused basilicæ, or exchanges, of which there were many in the larger Roman towns. It would seem reasonable to suppose that there must have been some transition stage between the nocturnal assembling in the secret recesses of the Catacombs of such Christians as had escaped the wild beasts, and the regular celebration of their rites in the largest and most public of all Roman buildings, but very little has hitherto been ascertained in regard to this part of their history. No doubt for a time after the religion of the Christians had been licensed by imperial decree, the rooms of ordinary dwelling-houses were large enough for their meetings, but the increasing number of converts must have made it desirable to seek more spacious accommodations, and Professor Brown believes that these were first found in the *scholæ*, or club-rooms, which at that time abounded in Rome and the provincial cities. As in our day hundreds of lodge-rooms, club-rooms, directors'-rooms and similar apartments are found necessary for affairs of business and pleasure, so in Rome the managers of the games, the various boards of public works, the mercantile and manufacturing societies, and many other bodies had their regular meeting-rooms, larger and more conveniently arranged for their purposes than the rooms of a dwelling-house, but not to be compared in size with the basilicæ. The examples which have been discovered of rooms apparently intended for such purposes often have a semi-circular apse at one end, probably to give dignity to the place of the president of the club or the chairman of the board, just as our lodge-rooms are furnished with a sort of central throne for the chief dignitary of the order; and this, in accordance with the Roman habit of working out, once for all, a convenient plan, and adopting it everywhere, was, perhaps, the usual arrangement. Nothing could have been more suitable for a small Christian congregation, and, as the decline of the Western empire must have left many of these rooms vacant before the basilicæ were deserted, the theory that they were used for Christian worship before the new sect became numerous enough to need the larger buildings is a very probable one. As the plan of the apsidal ones was substantially the same as that of the basilicæ, no modification of the ritual beyond a change in its scale was necessary in making the transfer from the smaller to the larger edifice, and this may account for the absence of comment on the subject in the church histories. That the use of the *scholæ* for meetings of small congregations of some sort continued down to a late period is, moreover, indicated by the use of the Italian form "*scuola*," which is employed to this day in describing a club or small corporate body.

THERE seems to be what would be called here a "boom" in railroad building in Switzerland. Two of the recently projected roads are intended as branches of the line from Zurich to Innsbruck, which, since the completion of the Arlberg tunnel, has become one of the greatest through routes in Europe, connecting England and France directly with Vienna and the East. One of these, starting from Chur, which is already reached by a branch from the main line, and is the centre of several diligence routes, runs first to Thusis in the Grisons, which is well on the way to the Splugen Pass, and a connection with the Italian system of railways at Bellinzona; but instead of continuing in this direction, turns off up the Albula valley toward the Engadine, terminating for the present at Filisur. As the Engadine valley is visited by swarms of tourists every year, this part of the line is tolerably sure to be profitable, while the portion from Chur to Thusis will form, perhaps, the starting point for another international line. From Landquart, another station on the Chur railway, a narrow-gauge road is to be built to Davos, a dark, cold valley much frequented by invalids on account of its pure air. Still another narrow-gauge line is projected from Altstätten, on the Swiss-Austrian main line, to Appenzell, following the present diligence route; while in another part of Switzerland a similar road is to connect with the present railroad which runs through Interlaken, running from Interlaken to the familiar point of Zweilütschinen, and there dividing, one branch going to Grindelwald, and the other to Lauterbrunnen; and a fourth is to be built in the suburbs of Geneva. Not content with these, most of which must depend for business entirely upon the patronage of summer tourists, two roads with toothed rails, like the Rigi railway and our own Mount Washington railroad, are projected; one from Interlaken to the Schynige Platte, a favorite point of view near by, at an elevation somewhat greater than either the top of the Rigi or of Mount Washington; and the other from Lugano to the top of a neighboring mountain, not very high, but with a beautiful prospect. Notwithstanding the difficulties of construction of the Swiss roads, most of them must be very profitable. Interlaken alone is said to have, on an average, a hundred and twenty-five thousand visitors every summer; and the projectors of the railway to the Schynige Platte think that they are sure of the fifty thousand passengers necessary to enable them to pay adequate dividends to the stockholders.

THE WATER-SUPPLY OF BUILDINGS.[1] — V.

SUPPLY-FAUCETS.



THE special devices or apparatus governing the supply of water throughout the house may be divided into four classes; first, faucets or the appliances placed directly at the ends of the pipes for the direct supply of lavatories; second, valves and siphons for the supply of water-closets, either directly or through cisterns; third, ball-cocks for the supply of tanks and cisterns, and fourth, stop-cocks or stop-valves placed in the line of piping to regulate the flow of water through the pipe.

Each of these classes may again be subdivided into two kinds, namely: "ground" and "compression." In the former all parts are made of metal, and the operation is independent of soft washers or packing. In the latter some form of compressible washer is required as a necessary part of the construction.

With ground-cocks a tapering plug or key of metal is fitted and ground into the casting forming the water-way, the plug being perforated with a hole as nearly as possible equal to the size of the bore of the pipe, in such a manner that if turned so that this opening is in line with the opening in the body-casting it opens a passage for the water, while if turned at right angles to the previous direction it shuts off the flow. At any intermediate position the flow is partially obstructed. The plug is made tapering so as to allow for tightening up by means of a strong spring at its small end. The close fit of the ground surfaces is intended to prevent leakage so that no packing is required around the handle-rod. But the ground surface is liable to be scratched and to cause a leak in usage.

With compression-cocks a straight plug is used, without perforation, and its operating surface is at its end rather than on its side. This end is armed with a soft washer of leather, rubber, or some suitable compressible composition, and is brought down upon the water porte of the body of the cock by means of a screw, lever, or spring to shut off the water, or it is raised more or less from this porte or seat to allow water to flow more or less freely. With ordinary compression-cocks a packing is generally used around the handle-rod, but the packing as well as the washer is liable to allow leakage after short usage and requires occasional repair. Moreover, when the compression is effected by means of a screw, as is usual, the threading wears out more or less rapidly according to the nature of the strain to which it is subjected.

Ground-cocks are particularly objectionable in places where the water is apt to contain much grit or mineral sediment in suspension, for in this case small particles of the gritty substances will get caught between the ground surfaces of the brass-work and cut them. If the cock is in a position where it has constant use in such water, it will very soon wear out, and when worn, repair is very difficult and expensive to make, so much so that it is usually found better to replace a dripping faucet by a new one. Ground-plugs are not so objectionable from the standpoint of wear in the case of "stop" or "shut-off" cocks, for the control of the flow of water through the main pipes, because they are not so often turned, but if used in these places they should be so constructed as to enable the water to run through them in a full stream. The so-called "round-way" stop-cocks permit of this and thus effect a much freer discharge from a line of pipe than where ordinary stop-cocks are used.

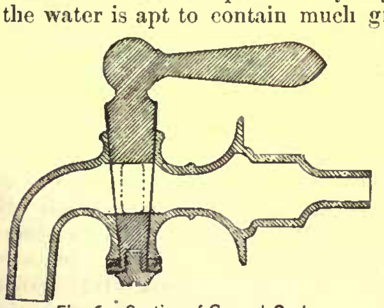


Fig. 6. Section of Ground-Cock.

There is, however, another and equally important objection to the use of ground-cocks which is independent of the quality of the water. Their sudden opening and shutting occasions a dangerous "water-hammer," which causes a shock to the pipes sufficient sometimes to burst them, especially after they have been weakened by use for some time. Accordingly it is a safe rule not to use "ground" faucets in places where the water pressure is likely to be great or varying.

Referring to these difficulties Mr. Gerhard writes in his "*Domestic Sanitary Appliances*," in the "compression" work both objections are successfully overcome. The flow of water is *gradually* cut off, and when finally checked does not cause any severe water-hammer or strain, hence such faucets are much more generally used. In case they become leaky it is owing to the wearing out of the leather washer, and this is easily replaced without requiring any great skill. A word of warning with regard to compression-work may not seem out of place. Whenever such bibbs commence to leak, avoid checking the leak by screwing the piston down too tight. This causes the quick wearing out of the screw-threads, and if once the latter become damaged, the faucet becomes worthless. The proper remedy is to at once replace a defective washer by a fresh one.

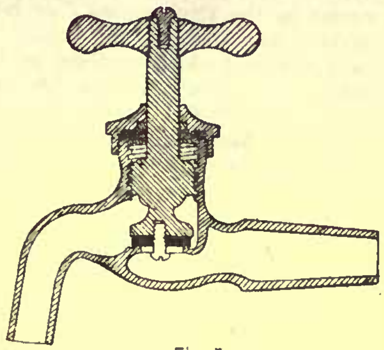


Fig. 7.
Section of ordinary simple Compression-Cock.

The initial cut represents an ordinary plain ground-cock or bibb with flange and thimble for connection with the supply-pipe. Fig. 6 shows the same in section explaining the construction. The ground plug is held tight against its seat by means of the spiral spring shown at the bottom. Fig. 7 shows the ordinary form of compression or screw-down cock. The water is shut off by the slow closing of a piston armed with a leather or rubber washer against a metallic seat. Any grit or sediment which might get caught between this valve and its seat cannot injure the metallic parts of the faucet. They simply impress themselves into the leather washer, which can easily be renewed in a few minutes, when worn away, as it will be in the course of time, by any person with common tools. The illustration shows the simplest form of compression-faucet made. The piston holding the washer is threaded and revolves the washer as it is screwed down. An objection to this simple action is the abrasion of the washer as it revolves in closing against its seat. To avoid this grinding of the washer, faucets are now made with pistons which do not revolve as they close. Fig. 8 represents one of the best examples of this form of faucet. The washer is held by a square piston which slides perpendicularly in a square groove. The screw which produces this motion is revolved by the handle of the faucet and works loosely in a female thread cut on the inside of the square piston, causing the latter to rise and fall instead of the screw and handle themselves, as in the simpler form. Thus the wear is taken off of the washer, and transferred to the metallic threading.

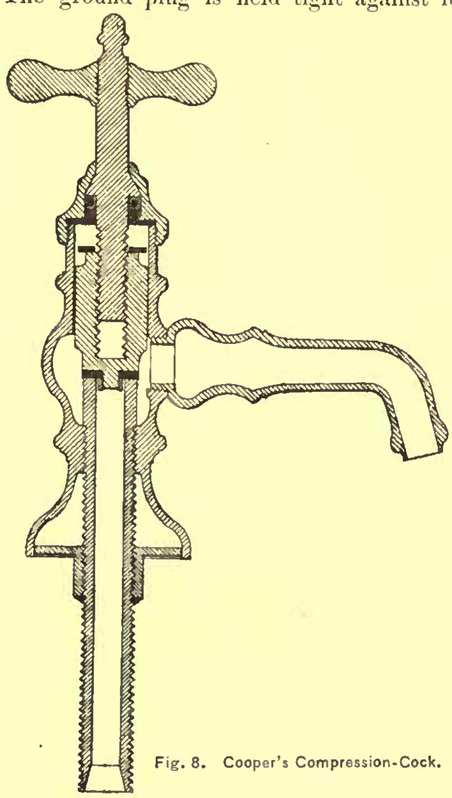


Fig. 8. Cooper's Compression-Cock.

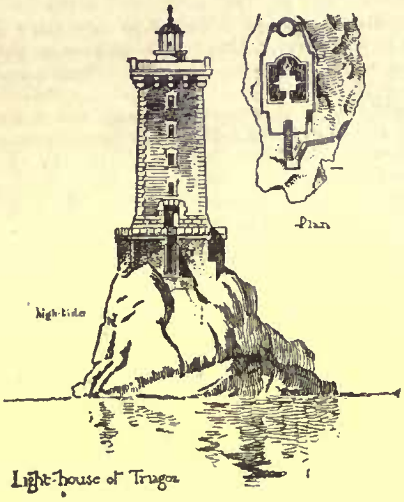
Additions to Cardiff Castle. — Lord Bute proposes to spend £50,000 in making extensive additions to Cardiff Castle. The work is to occupy four years, and about 200 men will be constantly employed. Lord Bute has already expended an immense amount of money on the castle. — *London Truth.*

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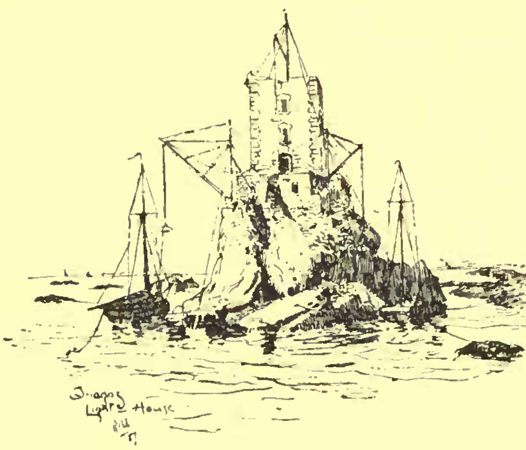
[1] Continued from page 184, number 590.

ANCIENT AND MODERN LIGHT-HOUSES.[1] — XIII.

LIGHT-HOUSE OF TRIAGOZ.



THE light-house of Triagoz in the Department of Côtes du Nord, France, is also established on an isolated rock in the sea called Guen Bras. The plateau of Triagoz is of considerable extent, being about four miles long from east to west by about one mile wide, but only isolated points of rock are exposed even in the lowest tides. The rock selected as the site of this light-house is the most elevated point on the south side, and, in consequence, marks the northerly limit of the channel followed by coasting-vessels. In front it has the appearance of an almost vertical wall, and on the opposite side it falls off with a depression in the surface forming a small open creek. This is the most accessible place during the three or four hours of low tide. The depth of water, which is over sixty feet at the lowest tides at the foot of the rock on the south side, increases rapidly as you leave it; the bottom is rocky, and the tidal currents so strong that the plan originally intended of keeping a vessel anchored here during the fine season to serve as quarters for the workmen, had to be abandoned. It was, therefore, necessary to build a hut, after having levelled off the summit of the rock, on the part corresponding to the interior opening of the tower. It enclosed a vertical post set in the centre of the structure, rigged with a boom for raising stones up to the work. The landing of the material was done by means of two derricks, one placed at the entrance of the little creek before mentioned, the other on the south-east end of the



rock. They were worked with great rapidity whenever the sea was smooth enough for landings to be made. The sketch gives a view of the work when the construction had been well advanced.

The base of the tower was fixed above the level of the highest tide; the edifice consists of a square tower with a salient staircase enclosure on one of its sides. On the level of the first floor is a vestibule leading to the staircase with a store-room on each side of it. There are three rooms above the ground floor, one of which is reserved for the engineers. They are roofed over with cloistered arches and are provided with fireplaces. In the upper part of the tower is the watch-room which serves at the same time as a store-room for implements that are to be kept free from moisture. The cast-iron stairway to the lantern leads from this room. A platform conforming to the shape of the rock surrounds the edifice; it is reached by means of flights of stairs, which are built into the side of the rock, starting from the point where the landing is least difficult. Under the front part of the platform aro store-rooms for fuel and other materials.

The work was executed in rubble masonry with cut-granite trimmings; the outside faces of these stones were dressed to give an appearance of rustic masonry. The work was commenced in 1861 and finished in 1864; it cost about $60,000. The tower is ninety-two feet high, the light is ninety-eight feet above high water, is of the third order, fixed, varied by red flashes, and is visible twelve miles.

THE SMALLS LIGHT-HOUSE.

Although it is not necessary to give further details of the methods employed in building sea-rock light-houses, yet before leaving this part of the subject it is proper to make reference to some incidents connected with the erection of the Smalls Light-house off the west coast of Wales. The motive which influenced Mr. Philipps, its constructor, was of a more elevated character than that of other light-house builders of his time. In lighting these dangerous rocks he proposed, above all, "to serve and save humanity." Sixty years later, when the heirs of this philanthropist ceded the structure to the Trinity House, they were awarded an indemnity of upwards of $850,000.



The task undertaken by Philipps was sufficiently unpromising. The rock selected for the site projects in ordinary weather twelve feet above the sea, but in rough weather, which is frequent in this vicinity, the rock is entirely submerged. At the time this work was undertaken, engineers were not so numerous as now, and Philipps had difficulty in finding a suitable superintendent; he did find one, however, in the person of a young man named Whiteside, a musical-instrument maker, of Liverpool, with a remarkable genius for mechanics.

In the summer of 1772 Whiteside first made the acquaintance of the place on which he was to indelibly grave his name. He disembarked on the rocks with a gang of Cornish miners, and the obstacles which they met at the commencement of the work nearly disgusted him with the enterprise. He and his companions had started the work when a storm suddenly broke upon them. The wind blew with fury, and the cutter which had brought them had to fly before the fury of the gale. The workmen left on the rock hung on the best they could for two days and nights. Whiteside, however, was not discouraged, and finally brought the work to a successful end, but not without being exposed to many dangers.

One day the dwellers on the coast picked up on the beach a "message from the deep," that is to say, a cask inscribed "Open this and you will find a letter;" inside was a carefully-sealed bottle and in the bottle a document as follows:

"SMALLS, February 1, 1777.

"*Sir,* — Finding ourselves at this moment in the most critical and dangerous condition, we hope that Providence will guide this letter to you, and that you will come immediately to our succor. Send to seek for us before spring or we will perish, I fear; our supply of wood and water is almost exhausted, and our house is in the most sad state. We do not doubt that you would come to seek us as promptly as possible. We can be reached at high tide in almost any weather. I have no need to tell you more, you will comprehend our distress, and I remain, Your humble servant,

"H. WHITESIDE."

Below this signature were these words:

"We were surprised on the 23 January by a tempest; since that time we have not been able to light the temporary light for want of oil and candles. We fear we have been forgotten.

"ED. EDWARDS, G. ADAMS, J. PRICE.

"P. S. We do not doubt that the person in whose hands this will fall will be sufficiently charitable to send it to Th. Williams, Esq., Trelethen, near St. Davids, Wales."

The history of Smalls has other and darker pages. It is related that at the beginning of this century there was a winter so stormy that for four months the two keepers were entirely cut off from any succor from shore. It was in vain that vessels were sent to the rock, the furious sea always prevented a landing. One of them returned one day with a strange report. Its crew had seen a man, standing and motionless, in a corner of the exterior gallery. Near him floated a signal of distress. But was he alive or dead? No one could say. Each evening anxious looks were cast at the light-house to see if its light would be shown, and each evening it shone brightly, proof that some one was still there. But were both keepers alive, and if there were but one, who was the survivor? This was learned later.

One evening a fisher from Milford who had succeeded in landing at Smalls in an intermission of calm weather, brought to Solway the two keepers, but one of them was a corpse. The survivor had made a coffin for his dead comrade, then, after having carried it to a corner of the gallery, he had stood it on end, attaching it firmly. Left alone he had done good service. When returned on shore he was so changed, so emaciated, that his relatives and friends could scarcely recognize him. He asserted that his comrade died of disease; he was believed, but after this time there were always three keepers at Smalls in place of two — a wise precaution which has since been taken for light-houses placed in similar conditions.

[1] Continued from page 232, No. 594.

LIGHT-HOUSES ON THE ATLANTIC COAST OF THE UNITED STATES.

Our Atlantic coast does not afford any examples of rocks as high as Tillamook, but there are many outlying dangers which had to be marked by powerful lights exhibited from tall towers.

At Petit Manan, for example, off the coast of Maine, is a tall granite tower carrying a first-order flashing-light at a height of one hundred and twenty-five feet above sea level, which can readily be seen at a distance of seventeen nautical miles. Clustered around the base of the tower are dwellings for the keepers and an additional dwelling has been built one hundred and fifty feet to the westward. The keepers at this station have not only to attend to the light, but also to a steam-whistle which is sounded during foggy weather.

The next important light along this coast is on Mt. Desert Rock. This tower was built with a very broad base and thick walls; at



times the sea has washed entirely over the rock, and the keepers with their families have had to take refuge in the tower. The keepers succeed in raising a few flowers and fresh vegetables in earth brought by boat from the mainland and deposited in sheltered spots. The station is noted for the number of sea-birds, especially gulls, which lay their eggs there. The keepers never molest them.

Matinicus Rock is twenty-five miles out in the ocean from the mainland, directly in the pathway of the ocean-steamers plying from



Boston and Portland to Eastport, St. John, Yarmouth and Halifax, and of the immense fleet of coasting and fishing vessels trading between the United States and the British Provinces. This barren and jagged rock, covering an area of thirty-nine acres at low tide, is inaccessible except during favorable weather, and on it stand the two towers, dwellings and fog-signal which comprise the Matinicus-Rock Light-station. The station was first built in 1827 and consisted of a cobble-stone dwelling with a wooden tower at each end. In 1846 a new dwelling of granite with a granite tower at each end was substituted for the old dwelling which was used for an out-house, and the wooden towers were removed. Steam fog-signals were placed here in 1856, and in 1857 the granite towers of the dwelling were cut down to the roof and two isolated towers erected farther apart than the old ones.

In the spring of 1853, Samuel Burgess obtained the position of light-keeper; his family consisted of an invalid wife, four small daughters and a son, who, though making his home on the rock, was absent much of the time fishing in Bay Chaleur and elsewhere. The eldest daughter, Abbie, fourteen years old, was the keeper's only assistant; she aided in caring for the light as well as attending to the principal household duties. In the occasional absence of her father, the whole care of the lights devolved upon her. She modestly says: "I took a great deal of pride in my light-house work and tried to do my duty" — a duty on the faithful performance of which depended the safety of many a vessel and its crew. She soon became proficient, and, as subsequent events proved, was fully competent to assume full charge. On the morning of January 19, 1856, Abbie then being seventeen years of age, the Atlantic was visited by one of those terrific gales to which it is subject. This was the same gale that destroyed Minot's Light-house and its keepers. Her father was away, and the following letter written by her to a friend will show the dangers and responsibilities in which this brave girl was placed:

"*Dear* ——, You have often expressed a desire to view the sea out upon the ocean when it was angry. Had you been here on the 19 January, I surmise you would have been satisfied. Father was away. Early in the day, as the tide arose, the sea made a complete breach over the rock, washing every movable thing away, and of the old dwelling not one stone was left upon another. The new dwelling was flooded, and the windows had to be secured to prevent the violence of the spray from breaking them in. As the tide came, the sea rose higher and higher, till the only endurable places were the light-towers. If they stood we were saved, otherwise our fate was only too certain. But for some reason, I know not why, I had no misgivings, and went on with my work as usual. *For four weeks*, owing to rough weather, no landing could be effected on the rock. During this time we were without the assistance of any male member of our family. Though at times greatly exhausted with my labors, not once did the lights fail. Under God I was able to perform all my accustomed duties as well as my father's.

"You know the hens were our only companions. Becoming convinced, as the gale increased, that unless they were brought into the house they would be lost, I said to mother: 'I must try to save them.' She advised me not to attempt it. The thought, however, of parting with them without an effort was not to be endured, so seizing a basket, I ran out a few yards after the rollers had passed and the sea fell off a little, with the water knee deep, to the coop, and rescued all but one. It was the work of a moment, and I was back in the house with the door fastened, but I was none too quick, for at that instant my little sister, standing at the window, exclaimed: 'Oh, look! look there! the worst sea is coming.' That wave destroyed the old dwelling and swept the rock. I cannot think you would enjoy remaining here any great length of time for the sea is never still, and when agitated, its roar shuts out every other sound, even drowning our voices."

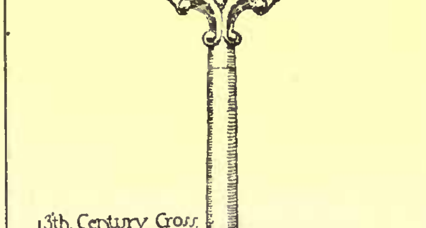
In the spring of 1857, Mr. Burgess left the rock to obtain his salary and secure needed provisions and fuel. The weather prevented his return, and the family ran short of food. Waiting till famine stared them in the face, the son started in a little skiff equipped with a sail, made by the aid of his sister, to obtain succor. Pushing from the rock in his frail craft, he was at first lost sight of in the trough of the sea, he reappeared on the top of the waves for a short distance and was seen no more for twenty-one days, during which time the mother and the four girls were reduced to a cup of corn-meal and one egg each per day. Added to risk of perishing of famine in mid ocean was the torturing suspense as to the fate of father and son. During all this time Abbie attended to the light, cared for her sick mother, and, by her spirit and example, cheered the little family clustered together on this wave-beaten rock in the Atlantic. Fortunately, father and son finally safely returned to their ocean home.

In 1861, Mr. Burgess was relieved of his duties by the appointment of Captain Grant and son. Abbie instructed them in their duties and in the same year married Mr. Isaac H. Grant, the son. The season of 1875 found her still on the rock, the mother of four children, and, a vacancy occurring at the White Head Light, Me., her husband was appointed keeper with her as assistant. They are still at this station, though it is her ambition to retire from the light-house service to a farm.

[To be continued.]

MAYALL'S PROCESS OF PHOTOGRAPHY IN COLOR.

THE following report, by Mr. Walenn, first published in *Invention* on the invention for producing photographs in color by Mr. J. J. E. Mayall, will be read with great interest by every one interested in photography:



According to request, I have examined Mr. John Jabez Edwin Mayall's patent specification, dated April 5, last. I have also had from Mr. Mayall himself certain illustrations and explanations of the process set forth in the specification above mentioned, and have arrived at the following conclusions:

The process is a continuous one for the production of permanent photographs — it is also a process of coloring the photograph by the use of chemical affinities having intimate relation to the action of the colors of the object photographed upon the photographic film.

In giving the theory or method of action of the process, in the

clearest terms, it is necessary to commence with the image first formed. This image is the one on the negative plate formed by actinic rays that emanate directly from the sitter. But the rays from the sitter convey more to the photographic film than the simple actinic or chemical rays, namely, the rays of white or combined light and the rays of colored or analysed light. The immediate suggestion is: Do the color-rays really affect the negative plate in a latent manner, so that they may be made manifest afterwards when a proper medium for their appearance, either selective or otherwise, is provided? To test this view it is necessary to compare it with the effects of each part of the process and with the result obtained.

The negative acts as its name implies in not doing what the positive does, or in doing it in the reverse way. The chemicals used are concerned simply in forming the image by the action upon them of combined light to produce form and gradations of the same neutral tint, according to the amount of photo-chemical action which takes place in the same duration of time on the various parts of the plate.

The colored rays that fall upon the negative have, nevertheless left an impression there, for they have different rates and qualities of vibration which the particles on the negative plate have felt the influence of; moreover, it is now known that they retain these rates of vibration and such other peculiarities of those vibrations as the chemicals used permit. Therefore, it remains to ascertain by a thorough analysis of the processes used in preparing the positive plate whether those vibrations of color, stopped off and stored up in the negative film, are allowed to become active on the positive film when the exposure again to light (under the negative) takes place. The principle here brought to bear upon the question is, that the negative and positive plates are registers of the vibrations which they respectively receive. If the above suggestion be the true one, this process is the nearest approach that has yet been made in photography to the practical realization and application of the relative color vibrations of light as determined by Dr. Young.

Prior to answering the question as to whether the process is such that the color rays from the sitter exercise a selective influence upon the ultimate color of the photograph in its various parts, color for color, it is well to remark that the inventor has put into practice certain broad principles, not rigidly observed before, but absolutely necessary to be adhered to if any approach to perfection be aimed at.

The manipulation commences quite anterior to that of other processes. Instead of accepting the paper, as furnished by the paper-makers, the inventor devotes his attention, at the various stages of the process, to perfecting the correctness of its surface; so that it may be perfectly plane. The value of this part of the general idea running through the whole process like a beautiful thread of exactitude is, that a truly flat surface is obtained to receive the image, by printing from the negative. In fact, the quality of the surface, as built up by the various processes, may be compared with that used in optics for reflecting or other purposes. This optical surface has another function, inasmuch as being mathematically correct, it limits the actions, catalytic in their character, which are in force to build up the colored image and causes them to be uniform in all parts of the photographic surface.

Another point that is steadily kept in view by this process is that the quality of the paper, or its initial covering of gelatine and albumen, is borne in mind, so that it may not be composed of a collection of fibres merely, but that, photographically speaking, it may be seen to be structureless, that is without granulation or fibre, even when submitted to the higher powers of the microscope.

The paper being thus built up with a view to its perfection of shape and quality, the requirements of after processes are kept in mind by the inventor from the beginning. In each process a basis is laid for some subsequent operation. Not only are the developing and fixing stages suitably provided for, but the balancing the chemical affinities from time to time and the operations necessary for the production of an ultimately unchangeable and permanent image are essentially attended to.

These points can be easily traced because of this continuity of design and purpose in the process as a whole, and because the inventor has had the courage, determination and ingenuity to begin at the very beginning, building up his excellent process step by step, and proceeding with magnificent march, gradually but perfectly to the end of his manipulations, till the final and truly artistic and scientific result is attained.

In sequence, the processes may be called: — 1, gelatinizing; 2, albumenizing; 3, sensitizing; 4, fixing; 5, coloring; 6, waxing; 7, setting the color; 8, glazing; 9, finishing.

In the first, or gelatinizing process, a basis is laid for subsequent development of the picture by the presence of lactate of iron; the film produced is oxidable, the iron waits for something to unite with it.

The second, or albumenizing solution, is still the more complex, and contains principles which aid the action of light upon the sensitizing salt afterwards to be applied. The interaction of the well-known substances, the glacial acetic acid (used to clear the albumen), chloride of sodium, and potassium bromide, is still kept in abeyance by the salicylic acid; the derivative of silex lays the basis of the vitreous coating afterwards to be given. The meconine (a derivative of opium which has special red coloration relations with iron) gives fair play to the formation of color and image, a peculiar bloom being thereby produced on the image. Owing to the organic radicles present, the condition of the chemicals already used is unstable; therefore the accomplishment of the following three things is rendered possible: — 1. A selective action by the vibrations or undulations of the light to which the plate is subsequently subjected; 2. The ultimate attainment of permanency; 3. The action, subsequently exercised, to fix the color when it is established and developed.

The third, or sensitizing process, provides for the diffusion of an exactly similar condition over the whole surface of the plate. The ammonia acts to equalize and absorb any of the unprecipitated parts induced by the action of the salicylic acid.

The use of weak sulphuric acid, after the fourth, or fixing operation, is a truly chemical improvement, as it provides more completely than has hitherto been done for the expulsion of the last traces of sodic hyposulphite. This part of the process also contracts the albumen and converts the argentic chloride into an oxide, which expands as the albumen contracts.

The fifth, or coloring operation, is peculiar to this photographic process, and provides a color basis from which the selection is made by the stored-up vibrations of light which the image has utilized, according to the color of the dress or appearance of the sitter. The colors dabbed on are reproduced in the photograph in the intensities and quantities of light and shade given by the negative plate.

The sixth, or waxing operation, stops the color from passing through the back of the picture; it also renders the paper impervious to moisture of any kind.

The setting of the color in the seventh operation, by means of salicylic-acid solution, brings into use its antiseptic qualities, and the other adjuncts assist in fixing the color and preventing its alteration by time.

The eighth, or soluble-glass process, is a fine and original method of effectually sealing the results of the previous work in a casing transparent and resistent to all atmospheric influences. The underneath silici surface may be said to be the plane of the picture, or the real pictorial surface.

The ninth, or finishing process, gives the plate a true, plane surface and provides for the permanence, protection, and unchangeability of the color, from the depth of tint of the final picture.

The colors applied are so attenuated and rendered so mobile during their application (as well as unchangeable in tint) that the greatest opportunity it given for the various interactions, actinic, photo-chromatic and selective, to assert themselves according to the original vibrations (color and otherwise), to which the sitter was subjected during the sitting.

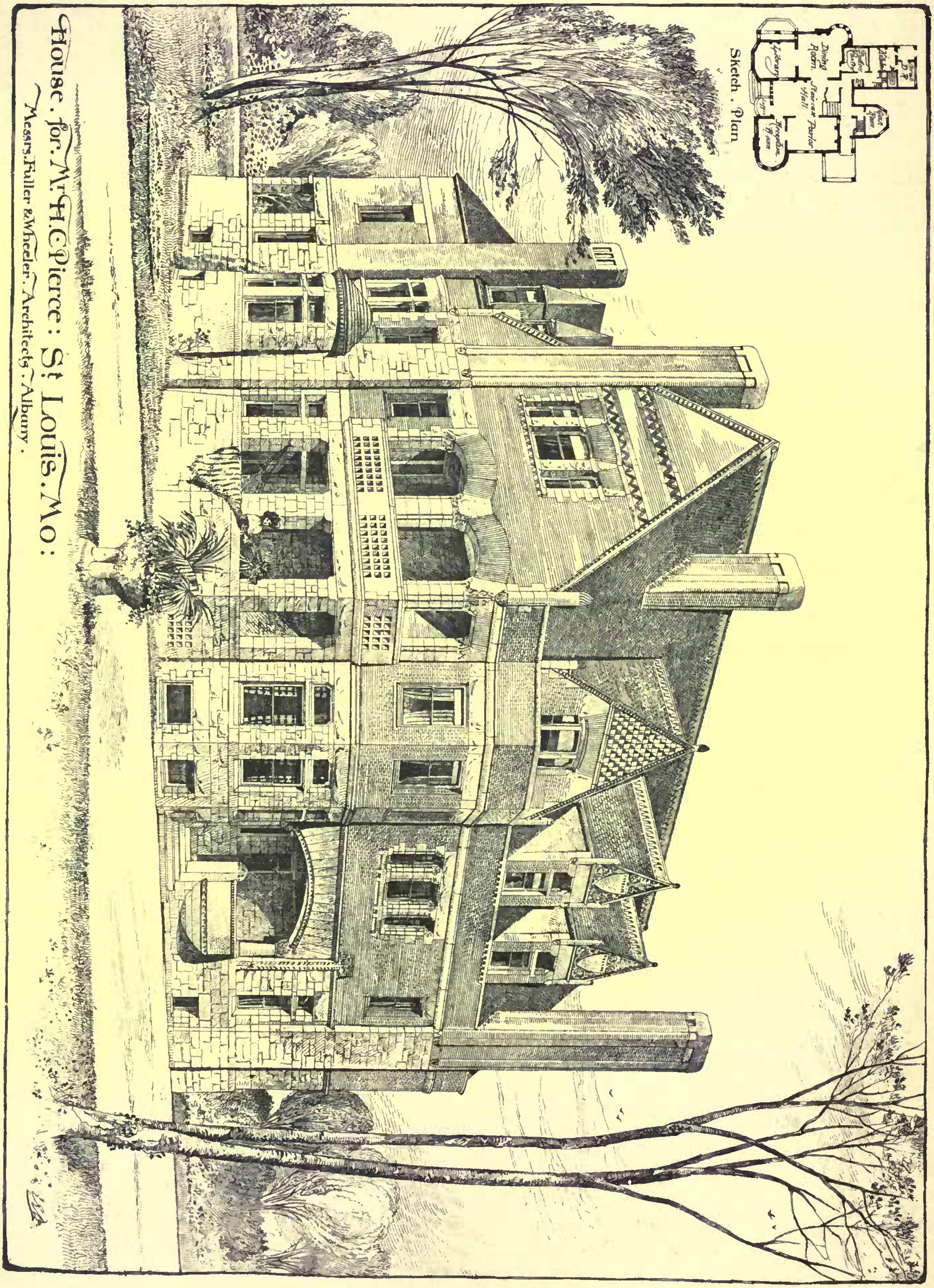
The remarks to each process will enable the reader to observe that if the color influences, and other photographic influences, are capable of being selected, finited and fixed, they have all the necessary opportunities for accomplishing these important and novel results in the most perfect manner.

In the "*Text Book upon Photography*" published in 1878 by Longman and Company, and written by Capt. W. de Wiveleslie Abney, R.F., F.R.S., pp. 9 and 10, is an admirable exposition of the molecular action of the rays of light in travelling through the photographic film, in which he establishes the transferrence of energy throughout. In regard to the storing up of the energy, which is ordinarily called "absorption of light," he says: "Now, according to all ideas of conservation of energy, this absorption must indicate the performance of some kind of work. It may be that it causes the already-vibrating molecules to take up and swing in some complicated manner with those rays particularly absorbed, and thus to cause a rise in temperature in the body, so small indeed, perhaps, as to be undistinguishable owing to the rapid cooling, due to radiation; or it may be that work is performed in effecting chemical decomposition." It should also be noted that "where light is not entirely absorbed, but is only reduced in intensity, even then, also, work must be performed by it; for the intensity of any colored or white light is dependent on the extent or amplitude, as it is termed, of the wave or waves; and any diminution of the amplitude indicates that a portion of its available energy has been exhausted, and that, therefore, a transferrence of the portion so expended must have been made to the body through which it passed."

The subject-matter of this quotation immediately replies, in the strongest affirmative terms, to the question originally propounded, namely: "Do the color-rays really affect the negative plate in a latent manner, so that they may be made manifest afterwards when a proper medium for their appearance, either selective or otherwise, is provided?" Moreover, from the processes above analyzed, it also appears that the color-rays from the sitter exercise a selective influence upon the ultimate color of the photograph in its various parts. When light is made use of a second time in producing the picture, namely, in photo-printing the positive from the negative plate, it takes up the rates of vibration and the qualities of the vibrations of the negative in a complementary manner, and gives to the positive plate all the characteristics of molecular condition (including latent color vibrations), that it would have had if the positive had been taken at once, without the intervention of a negative, suitable chemicals being used.

The film of form, depth of tint, and color exists between two perfect films of glass, produced by the processes above detailed and annotated upon. This important part of the very fine and perfect results obtained has reference to the attainment of absolute permanency and comparative indestructibility in the finished picture.

The conclusion, therefore, at which I gladly arrive is that Mr. Mayall's process is the most perfect of its kind, both in regard to

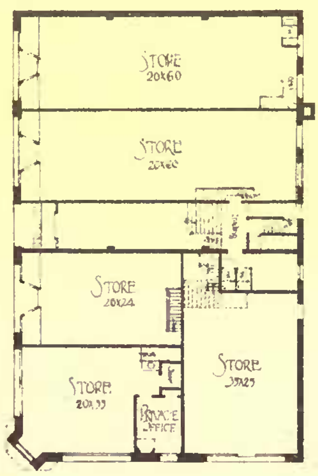


Heliotype Printing Co. Boston.

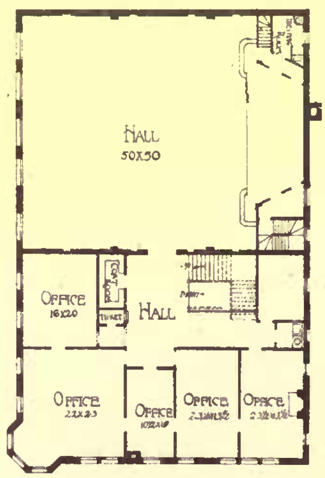
BUILDING AT WOBURN, MASS. FOR MESSRS. A. A. AND E. A. DOW.

ANDREWS & JAQUES, ARCHTS BOSTON, MASS.

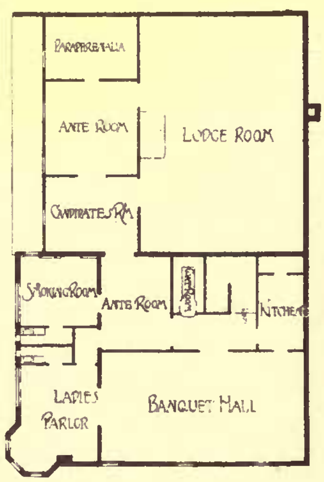




FIRST STORY



SECOND STORY



THIRD STORY

Heliotype Printing Co. Boston

Sketches in Providence R.I.



A typical Providence Residence of 50 or 60 yrs ago.

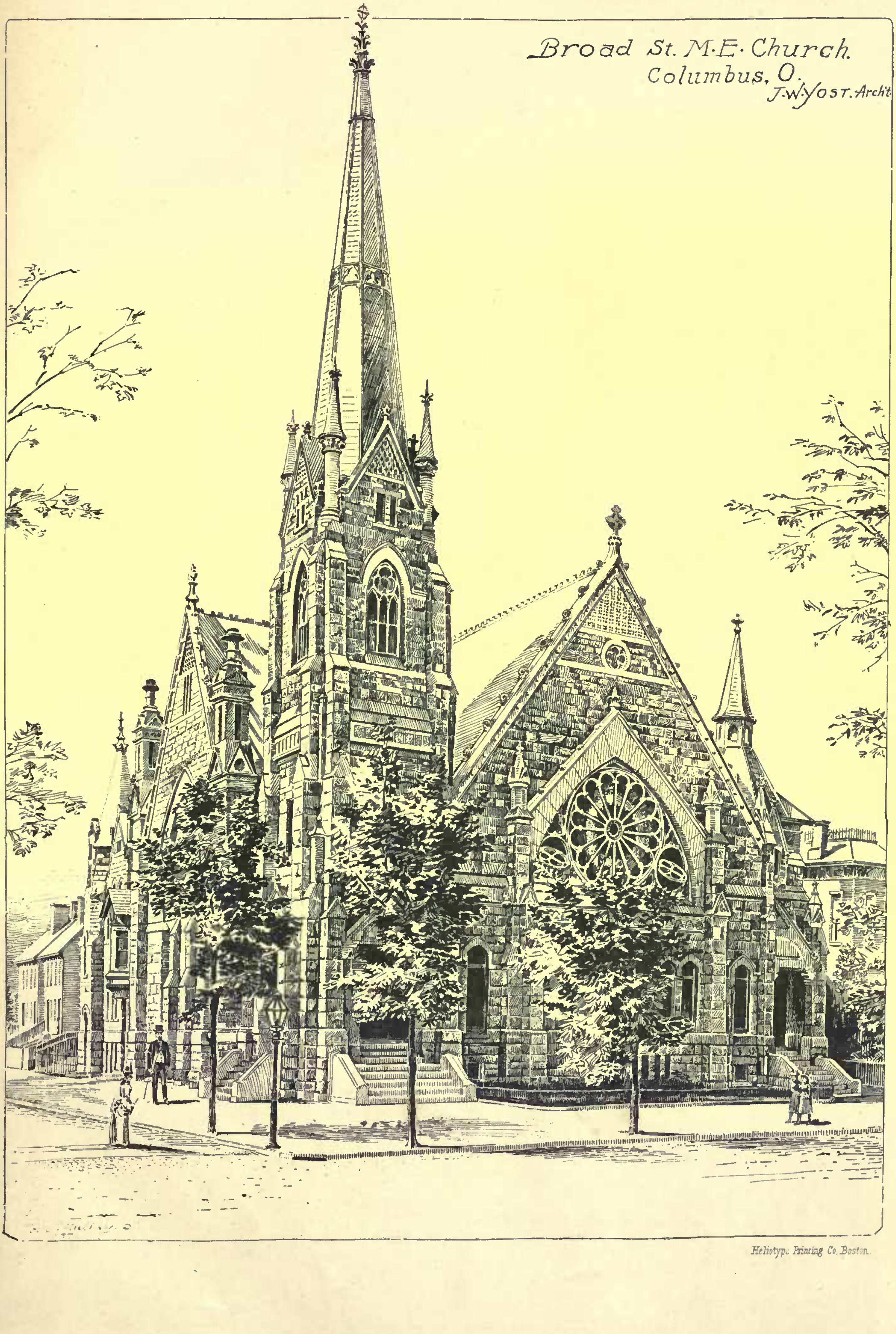


A couple of Residences with Stores under on South Main St: built about 50 years ago.

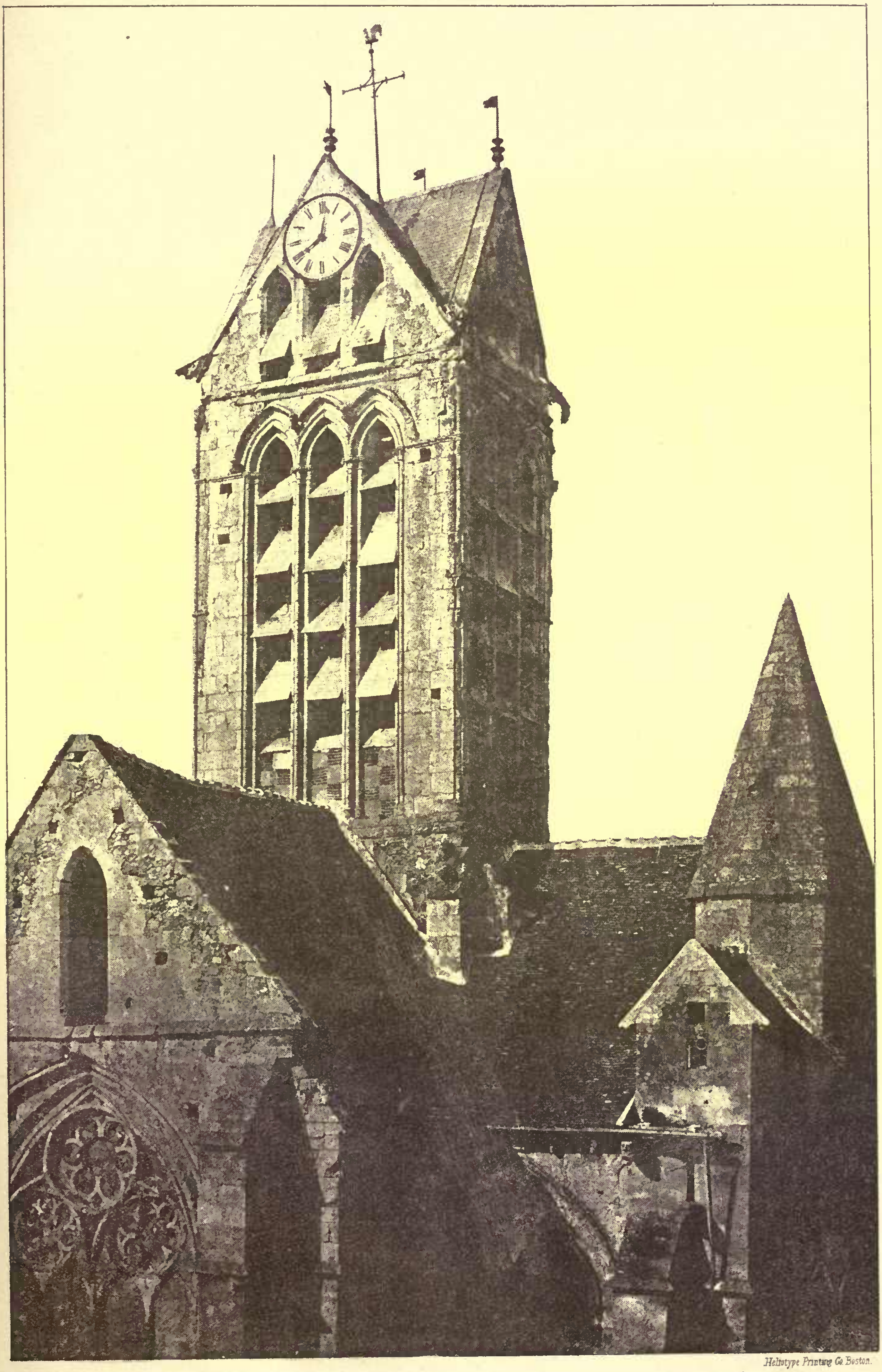


Yard and Stabling to the above.

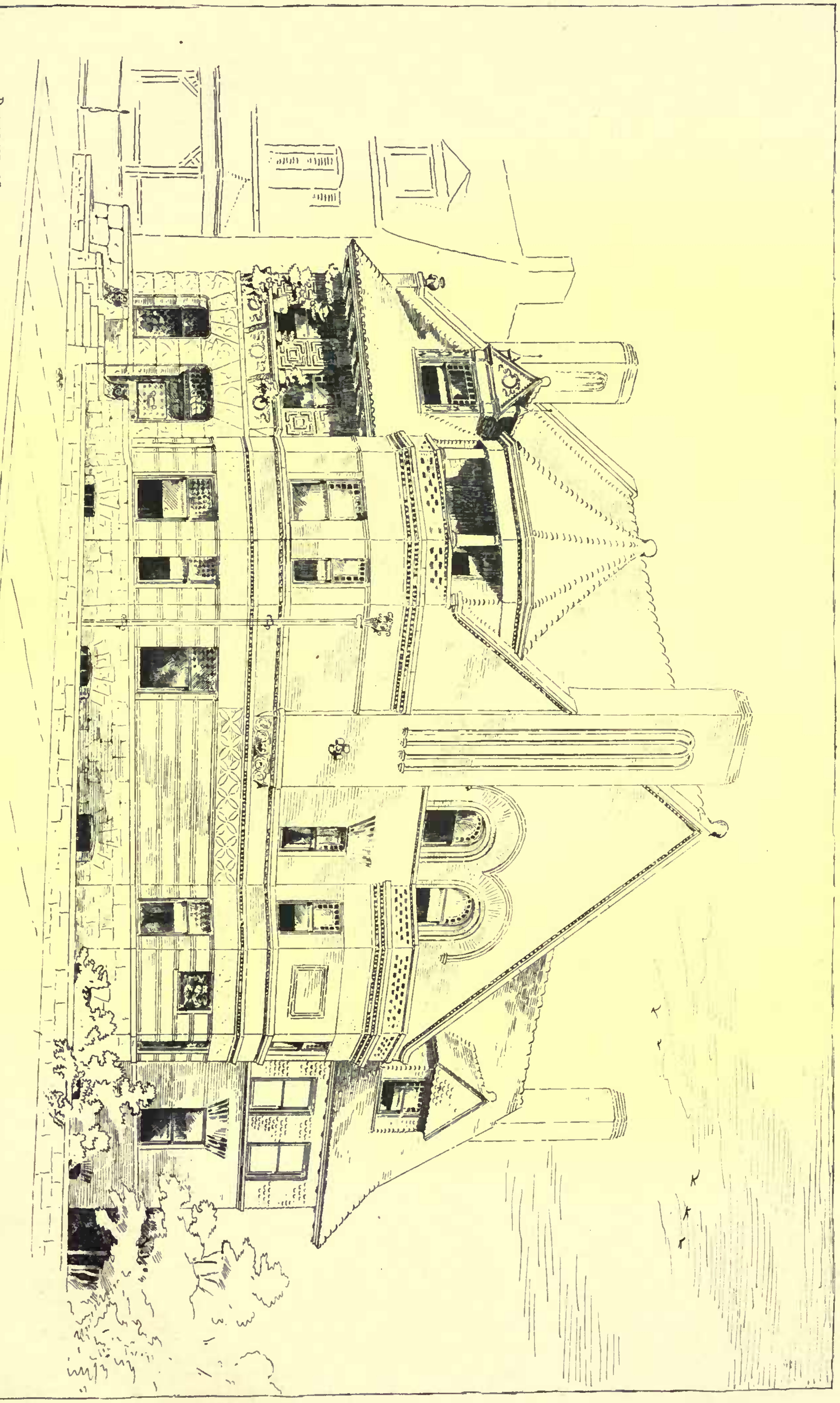
Heliotype Printing Co. Boston



Heliotype Printing Co. Boston.



Heliotype Printing Co. Boston.



Residence of
∴ Mr F. L. Barbott ∴
· Lincoln · Place ✱ Brooklyn · N. Y ·

· Lamb · and · Rich · Architects ·

Heliotype Printing Co. Boston.

its perfection of optical form, its selection of the precise color of the sitter, and its permanency.

W. H. WALENN, F.I.C., F.C.S.

THE ILLUSTRATIONS

[*Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.*]

CHRIST CHURCH, ANDOVER, MASS. MESSRS. HARTWELL & RICHARDSON, ARCHITECTS, BOSTON, MASS.

[Gelatine Print, issued only with the Imperial Edition.]

BROAD STREET M. E. CHURCH, COLUMBUS, O. MR. YOST, ARCHITECT, COLUMBUS, O.

THIS church was built a year ago at a cost of $67,000. It is of Pennsylvania greenstone, finished in oak and cherry; hard oil finish.

HOUSE FOR H. C. PIERCE, ESQ., ST. LOUIS, MO. MESSRS. FULLER & WHEELER, ARCHITECTS, ALBANY, N. Y.

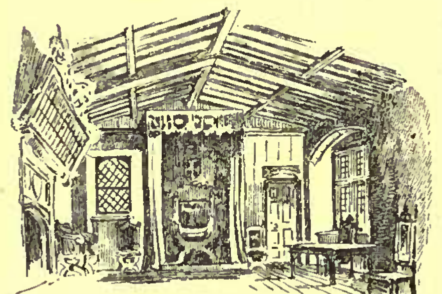
HOUSE FOR F. L. BABBOTT, ESQ., BROOKLYN, N. Y. MESSRS. LAMB & RICH, ARCHITECTS.

BUILDING FOR MESSRS. A. A. & E. A. DOW, WOBURN, MASS. MESSRS. ANDREWS & JAQUES, ARCHITECTS, BOSTON, MASS.

SKETCHES AT PROVIDENCE, R. I.

CHURCH AT DORMANS, FRANCE.

THE LATE M. RUPRICH-ROBERT.



"The Chancery" Chamber St. John's Gate. London. Engd. date 1504. used by the Order of St. John of Jerusalem.

THE death has been announced of M. Ruprich-Robert, who held a distinguished place in the ranks of French architects. In *La Construction Moderne*, M. Maurice du Seigneur gives the following account of his life and works:

French art has sustained a great and veritable loss, for he who has just died was not only a master in the full sense of the word, but also one of those rare spirits who seem to be the guardians of the primitive forms of our national architecture, a scholar who was conscientious and precise, fascinated with the study of the past, and careful of the independence of artists in the future. Ruprich-Robert belonged to that valiant school who defended Mediævalism against the stupid attacks of routine and conventionalism. Like Viollet-le-Duc, he was one of the most vigilant and sagacious of the restorers of the monuments which were termed Gothic by the successors of the famous Petit Raidel, the imaginative architect who proposed to transform the pillars of churches of the fourteenth and fifteenth centuries into Doric columns resembling those of Pæstum. It must be said, however, that if Ruprich-Robert preferred Mediæval art, it would be unjust to fail in recognizing his respect for the works of antiquity, and for the works of a later time which were inspired by them. With so vast and honest an intelligence, he was perfectly able to comprehend the gracious adaptations of the Renaissance, as seen in the pomp of the seventeenth century and the caprice of the eighteenth. His protests and disdain were reserved for the immaturity and want of equilibrium of the present; his apprehensions, which were expressed with energy, were excited by the menacing apparition of that official art which is sure to lead to the panalities of academicism of the official sort. I have had the privilege of late to listen to the conversation of Ruprich-Robert, and amidst the terrible sufferings he endured from a disease for which there was no remedy, he was constantly preoccupied with the work of his life. He was anxious to see the failure of certain attempts at monopoly which were effected in the interests of men inspired by a narrow and unworthy ambition; he was eager to see a renewal of that spirit of freedom which is manifested in so many old cathedrals and manor-houses. His heart was full of warm emotions when he spoke on these subjects, although from his rigid and severe expression he might be thought imperturbable.

In appearance Ruprich-Robert resembled one of those respectable and austere figures of apostles that are seen under canopies in the doorways of churches, and as they seem to smile at the young birds who build amidst the sculpture of the tympanum, so he regarded with affection the students who were to be the architects of the future. His opposition on the subject of official diplomas must not be misunderstood. He was the first to recognize how much had to be gone through before gaining one of them, and also the talent and capacity of the competitors, but he feared that the diploma would lead to the supremacy of mediocrity in art, of which he was always an opponent.

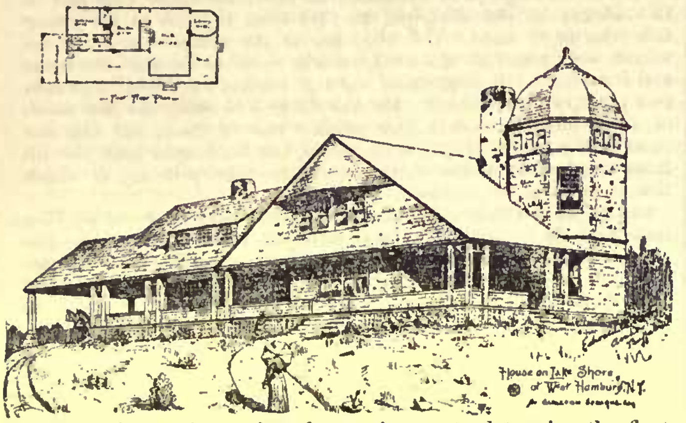
Victor Marie Charles Ruprich-Robert was born in Paris on February 18, 1820. At sixteen he entered the *atelier* of Constant Dufeux, and during the five years he remained in the Ecole des Beaux-Arts was recognized as studious and capable. He became attached to the Commission of Historic Monuments in 1844, and exhibited for the first time in the *Salon*, the subject of his drawings being the Templar's Church at St. Gaudens, which dates from the twelfth century. They were for the Commission, and were followed by others which were also intended to be deposited among the archives. In the *Salon* of 1847 he exhibited drawings of St. Nicholas, Caen; in 1849 the church of St. Luke, Calvados, and the doorway of the church of Seez. He sent also a design for a sculptural monument. A second-class medal was awarded to him at the International Exhibition of 1855 for the drawings already mentioned, which were re-exhibited with others of St. Sauveur's, Dinan, and a project for the restoration of the Abbaye aux Dames, Caen. Afterwards he was appointed professor in the special school of design and mathematics in the Rue de l'Ecole de Médicine. There he delivered a remarkable course on the history and composition of ornament, in which he developed the principles of his well-known book, "*La Flore Ornamentale.*" The school, which had supplied French industry, and even contemporary architecture, with some useful men, gained one of its most firm and intelligent supporters in the new professor. The school is installed in its present position since 1776; the amphitheatre, formerly used for surgical operations, was built between 1691 and 1694 by the architect Charles Joubert. As the school which is familiarly known as La Petite Ecole adjoins the new Ecole de Médicine, a project for its proposed demolition, in order to allow more space for the new buildings, and to widen the very narrow street, has been long seriously considered. The removal of the school of design caused much concern to Ruprich-Robert. He was also actively engaged in the efforts to obtain the remains of the ancient church of St. Julien le Pauvre in the neighborhood as a substitute. The church itself could be transformed into a museum of decorative art, and a lecture-hall and new buildings could be added for class-rooms. The proposal would have the double advantage of rescuing an historic monument that is precious, and of utilizing it in a manner more worthy of its origin and character than by converting it into a museum of hygiene, which is the desire of the Municipal Council.

In the *Salon* of 1868 Ruprich-Robert exhibited drawings of the church of Flers (Orne), constructed by him between 1858 and 1864, and a design for a *couronne de lumière* for the abbey of Ensiblin. In the *Salon* of 1873 appeared his project for the restoration of the Château d'Amboise. The churches of Ouistreham and Bernières were also restored by him, and drawings were exhibited in 1878. For his drawings and designs in the International Exhibition of 1878 he obtained a first-class medal. In 1879 he exhibited several views of the church of Fresne Camilly, Calvados, and in 1870 no less than twelve important drawings of doorways and façades. Ruprich-Robert was a chevalier of the Legion of Honor since 1861, and in 1880 he was raised to the rank of officer. In 1878 he was appointed inspector-general of historic monuments.

He contributed at one time several articles to the *Revue de l'Architecture*, and was the author of a pamphlet entitled "*Le Premier Décorateur, c'est l'Architecte,*" and of others on the churches of the Trinity and St. Stephen, Caen, the château of Falaise, and the church and monastery of Val de Grâce. The work which has made his name most prominent is the "*Flore Ornamentale,*" a folio-volume with one hundred and fifty-two plates. He also wrote about the influence of public opinion on the conservation of ancient monuments, and about the "*Arènes de Lutèce.*" The most important of his books is known as "*L'Architecture Normande aux XI^e et XII^e Siècles en Normandie et en Angleterre.*" It is the result of thirty years of study and observation, and exhibits in a new light the success of the art on both sides of the Channel. It contains one hundred and seventy engraved plates, historic and descriptive letter-press illustrated by about two hundred designs. The last months of the life of M. Ruprich-Robert were employed on the completion of this work, which is a veritable historic monument. The foundation of it was laid as far back as 1857, when he began the collection of materials for the restoration of the celebrated Abbaye aux Dames at Caen. I have witnessed the marvellous energy and tenacious power with which he labored upon the book. In the intervals of his intense suffering he jealously scrutinized the engraving and the printing of the plates.

During his latter days he was surrounded with all the tenderness and affection that his family could bestow. It was in Cannes on May 7, at half-past six in the morning, that he expired. He left three sons, one of whom, M. Gabriel Ruprich-Robert, was the faithful and intelligent auxiliary of his father, and who will, no doubt, as an architect, uphold the credit of his name. His father's work and life may be summed up in two words, "Science and Conscience."

WOOD-DRYING EXPERIMENTS.



A very interesting series of experiments to determine the fluctuations of moisture in various woods during seasoning has lately been closed by the Chicago, Burlington and Quincy Railway at the Aurora shops. The experiments, says the *Railway Review* in a recent article, are being continued, but the first series ended in February, having been commenced December 21, 1885. The prime object of this work was to discover the laws of seasoning, if such laws existed, and thus to ascertain in what months the greatest amount of seasoning takes place, and whether wood thus seasoned reabsorbed moisture during the wet months of the fall and winter.

The work was undertaken in a very systematic way, and was done about in this wise: Three pieces of rough dressed oak, ash and Norway pine, thoroughly green, were piled loosely, with cleats between, with a board overtopping all, in a situation where they were protected against drip and direct rain, but where they were open to rain, snow and the sun on their sides. The conditions were, as nearly as possible, those to which lumber piled for out-door seasoning is usually subject. The dimensions of these pieces at the start were as follows:

Pine, cross-dimensions, 9½ x 5¼ inches. Length, 14 feet 2 inches.
Oak, cross-dimensions, 8¾ x 5¼ inches. Length, 9 feet 6 inches.
Ash, cross-dimensions, 8¾ x 4½ inches. Length, 7 feet 5 inches.

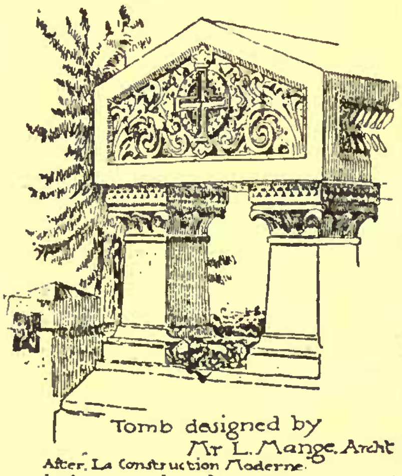
On each alternate week pieces of wood were sawed from these timbers. From the piece of pine 5¼ inches were sawed off the same end every time, and borings taken from the centre of the sawed-off block. From the ash 4 inches were sawed off for each of the first 11 tests, and 3 inches for each of the remaining 13 tests. From the oak 5 inches were sawed off for the first 11 tests, and 3 inches for the remaining 14 tests. The borings taken from these pieces were carefully weighed, then thoroughly dried out and again weighed, which process gave the percentage of moisture in each piece. The borings were always taken from the centre of the block. By arranging the results of each fortnightly test the following tabulation is made, showing the fluctuations of moisture during the whole period of one year, two months and one week. The exact percentages of moisture thus obtained are given in the following table:

Date.	Percentage of moisture.		
	Oak.	Ash.	Pine.
December 21, 1885	40.93	27.56	24.25
January 4, 1886	40.76	27.36	23.35
January 18, 1886	40.01	28.27	23.53
February 1, 1886	42.36	28.31	23.84
February 15, 1886	42.63	28.98	23.88
March 1, 1886	42.14	28.87	23.25
March 15, 1886	42.53	28.25	23.12
March 29, 1886	42.03	27.25	22.62
April 12, 1886	41.25	26.66	22.44
April 26, 1886	41.23	24.68	21.63
May 10, 1886	39.45	22.98	20.83
May 24, 1886	37.29	22.79	19.40
June 7, 1886	37.05	20.78	17.81
June 21, 1886	36.79	20.58	18.14
July 6, 1886	35.70	17.78	16.14
July 19, 1886	36.77	15.84	15.74
August 2, 1886	34.99	12.74	12.65
August 16, 1886	35.91	13.84	14.02
August 30, 1886	35.03	14.06	14.04
September 13, 1886	34.65	13.26	13.33
September 27, 1886	36.66	13.00	15.36
October 11, 1886	33.54	12.02	13.48
October 25, 1886	33.50	13.77	14.28
November 8, 1886	33.33	14.02	14.41
November 22, 1886	Stolen.	13.78	14.68
December 6, 1886			14.55
December 20, 1886			14.92
January 4, 1887			14.49
January 17, 1887			14.10
January 31, 1887			14.61
February 14, 1887			14.35
February 28, 1887			14.61

The above figures indicate that there was a slight increase in all three kinds of wood between January 4 and February 15. The seasoning — that is, the loss of moisture, began practically February 15, with all three woods, and ended August 2 with the ash and pine, but with the oak October 11 seems to have been the finish. The results with the oak were not altogether satisfactory to the experimenters. The present second series of experiments will, it is hoped, throw more light upon this kind of wood. From February 15 to August 2 the ash dropped from 29 to 12½ per cent, a loss of 16½ per cent. From August 2 to its finish, December 20, the fluctuations were between 12 and 14 per cent, the exact average being 13.27 per cent.

From February 15 to August 2 the pine dropped from 24 to 12½ per cent, a loss of 11½ per cent. From August 2 to its finish, February 28, its fluctuations were between 12½ to 15½ per cent. From October 25, 1886, to February 28, the exact extremes were 14.10 and 14.92 per cent, a difference of only 0.82 per cent. The extreme fortnightly fluctuation was 0.51 per cent. The average fluctuation was 0.30 per cent. The average moisture for that period was exactly 14.50 per cent. These experiments cannot be taken at present as supplying infallible data, but in a general way it may be said that they lead to the conclusion that as regards oak, ash and pine woods in a green condition, seasoning begins in very early spring (depending, of course, largely upon the kind of weather), and ends in midsummer. The provisional limits of this drying season may be fixed at the 1st of March to the 1st of August — in other words, including the months of March, April, May, June and July. It has also been shown that as regards ash and pine, after seasoning is effected, the wood will not take back water — that is, not beyond slight amounts during the wet and cold seasons. These conclusions are true only for the inmost parts of the woods in question and of the sizes experimented upon. Variation in the character of the wood, condition at the time of cutting down the tree, treatment between that time and the first time of testing, sizes of pieces, etc., may alter the conclusions, although probably they would not materially do so. The data which has been gathered in this way can be used to material advantage in many ways, notably, however, as an aid in the purchase of cars and in the purchase of timber. With the exact knowledge that it affords of the seasoning properties of different woods, and of the months during which the seasoning liable to be hastened or hindered, the guesswork of sellers of lumber and makers of cars can be readily checked.

THE RELATIVE ECONOMY OF ELEVATORS.



In most instances the conditions of the supply of motive power are such that it would be feasible to use any of several well-known types of elevators, but it is equally true that in many instances the selection is based upon superficial motives without due consideration of what constitutes the greatest economy of all the elements entering into the problem. In fact, there is but little data upon which such estimates can be accurately based. Mr. Edward E. Magovern, of the New York Steam Company, has given much attention to the matter, and his conclusions are based upon a systematic experience for five years upon upwards of six hundred elevators in actual use in the city of New York. The results are relative, being, of course, based upon the actual cost of plant, repairs, attendance, fuel, and water at the market rates prevailing in the locality under examination, but this does not impair the value of the results, as in case of differences the same methods can be applied to other markets. The results in each classification are based upon the relative values given to each element of cost, the allotment for motive power being, 100; the interest on initial cost, 33⅓; expense of repairs, 27½; cost of attendance, 95; so that the maximum value would be 255.83. The elevators are classified as to their motive power, whether derived from intermittent steam engine, continuous steam engine, hydraulic elevators operated by public water-supply, hydraulic elevators actuated by head of water supplied by an open tank on the roof kept full by local pumps, hydraulic elevators driven by the water-supply forced into closed tanks by local pumps, and belt elevators. The results are based upon conditions of uniformity of load and trips per day in order to be strictly comparable with each other. Arranging his conclusions in tabular form, varying slightly from his method of presentation, they are as follows:

Motive Power.	Cost of Motive Power.	Interest on Initial Cost.	Cost of Repairs.	Cost of attendance.	Totals.
Belt elevators	12.00	5.00	24.75	9.50	51.25
Public water-supply	8.00	16.67	5.5	47.50	77.67
Continuous steam engine	40.00	15.00	27.50	28.50	110.00
Open tank	18.00	30.00	11.00	71.25	130.25
Intermittent steam engine	60.00	28.33	16.50	80.75	185.58
Closed tank	100.00	33.33	13.75	95.00	242.08

The following table shows in the last column the total economy of each type of elevator under the conditions of those under examination, out of a maxi num cost represented by 255.83. Reduced to percentages of that number, the relative cost would be

Belt elevators	.2005
Public water-supply	.3037
Continuous steam engine	.4300
Open tank	.5091
Intermittent steam engine	.7254
Closed tank	.9463

The relative cost of each motive power, interest, repairs, and attendance for each type is shown by the following table:

Motive Power.	Allotment of Values.			
	100	33⅓	27½	95
	Cost of Motive Power.	Interest on Initial Cost.	Cost of Repairs.	Cost of Attendance.
Belt elevator	12	15	90	10
Public water-supply	8	50	20	50
Continuous steam engine	40	45	100	30
Open tank	18	90	40	75
Intermittent steam engine	60	85	60	85
Closed tank	100	100	50	100

It will be noticed that no consideration is given to the cost of elevators operated by hydraulic water-supply at great pressure furnished for power purposes from mains and plant owned by a company, or by compressed air furnished in like manner, as neither of those methods of distribution of power are used in any American city. Nor is any reference made to electric motors used for elevators, although there are a number of such elevators used in Boston and New York and in smaller numbers elsewhere, generally in connection with the leads from an electric-lighting station furnishing electricity for incandescent lights. Power furnished in that manner would in general exceed that derived from any of the sources mentioned in the table, although their use is well fitted to many places where the above methods are not convenient of application. It is not to the credit of the engineering skill of those engaged in the exploitation of electric motors that in many instances their application to elevators is made by using the motor to drive a pump which forces water into either an elevated or a closed tank, increasing the number of conversions of energy and the losses attendant thereon in an unnecessary measure. They should rather apply their skill to the production of electro-motors which would operate with the needful smoothness, and also be subject to the small range of motions and ready control by the operator as is requisite in all elevators.—*Iron Age.*

BOOKS AND PAPERS.

MR. GERHARD has given us what might properly be called a "pocket-book"[1] of useful information for house-owners and house-builders in the department of Sanitary Drainage and Plumbing.

The subject matter is divided into four parts, the first dealing with the general principles of house drainage under the heading of "Recent Progress in House Drainage and Plumbing"; the second, under the heading of "Maxims of Plumbing and House Drainage" discusses in detail the requirements as to material, workmanship and arrangement of sanitary plumbing; the third gives "Suggestions for a Sanitary Code"; and the fourth particularly fills a want long felt in giving a Memorandum of the Cost of Plumbing Work.

In Part I are emphasized the leading points which mark the recent progress in sanitary drainage; the interest taken by the public in these matters and the increased attention given to them by architects and legislators. Sanitary journals have multiplied, sanitary laws been enacted and sanitary inspection enforced; and these factors have resulted, as a whole, in a great improvement in the public health and welfare. In most cases the legal requirements have been wise and salutary and the sanitary periodicals have been conducted generally with a view to the public good; but there are unfortunately many important exceptions to this, which as Mr. Gerhard rightly says "hinder as rapid a progress as might have been expected." There are noted instances where sanitary periodicals have misled the public in matters of vital importance, publishing only one side of questions requiring impartial treatment. This has had the effect of enforcing and retaining in force in some cities, provisions in the laws which are of doubtful utility, and others which are undoubtedly pernicious. In deprecation of such provisions of the law, the *Sanitary Record* of London in a leading article of the May number of this year, fully confirms the views of our author as follows: "When the use of S and P traps under sanitary fittings became general in England, it was soon found that, in practice, the contents of these traps were occasionally siphoned out. . . . Many authorities have asserted that the only protection against this danger is that afforded by ventilation of the traps. Against this practice we must set off the cost and complication of pipes involved, the danger from the evaporation of the contents of the traps, and from frost. A diagram of house-plumbing protected by ventilation pipes as prescribed by most American authorities is a nightmare of complicated ingenuity. The extra cost involved by the ramifications of the trap-vent system is obvious enough, while the danger from evaporation and frost will hardly be contested. . . . We know that in practice the entrance from the trap to the vent-pipe is often found to be partially clogged with grease, hair, etc., and such diminution of its sectional area may seriously lessen its practical value . . . so that in America, at any rate, where self-cleansing antisiphonic traps are to be obtained, it would appear to be rather unwise to continue the use of ventilated S-traps.

Accordingly, in his "Suggestions for a Sanitary Code" Part III, Mr. Gerhard omits the trap-venting-clause and wisely substitutes for it the following: "Every fixture in the house shall be separately and effectually trapped by a seal-retaining trap placed close to the fixture and arranged so as to be safe against back-pressure, self-siphonage, loss of seal by evaporation or siphonage."

This seems to us to be as judicious a wording of the provision as could be found except that, instead of the words "close to the fixture" we should write "as close to the fixture as possible," since in some rare cases it might be desirable to slightly lengthen the pipe between the fixture and its trap as a precaution against back-pressure where other simple means were not convenient.

The same care and good judgment is shown throughout the "Suggestions" as in the clause we have selected as an example, showing that the author has given the subject impartial study from a practical standpoint, and not merely followed blindly a beaten track, or made innovations without sufficient caution or knowledge, as has been too generally the case with plumbing-law makers.

Mr. Gerhard's provisions relating to the sanitary preparation and drainage of building sites and to the damp-proofing and ventilation of floors and walls are excellent, and should be generally introduced into our sanitary codes. His "Rules as to the connection between House-drains and Street-sewers" call attention to subjects much overlooked in our plumbing laws. They are rigid and ample but never superfluous, and their adoption would protect the public without crippling the plumber.

This remark may be applied to Mr. Gerherd's entire chapter of "Suggestions." They should be very carefully studied and adopted by our Boards of Health and Legislators.

The last chapter giving memoranda on "The Cost of Plumbing Work," is very valuable and fills a want long felt.

In short, the entire work is valuable from cover to cover, and should be read not only by every conscientious architect and builder, but by every one who desires to occupy a healthy home.

M. PLANAT'S "*Pratique de la Mécanique appliquée a la Résistance des Matériaux*"[2] is undoubtedly one of the most noteworthy — if not the best — recent contributions to the practical literature of Architecture. Unlike Box's "*Strength of Materials*" or other similar recent works which are apparently written for the engineer only, with little if any thought of the architect, this book is *entirely* devoted to what might be called the engineering of architecture; and there is hardly a problem likely to arise in architectural practice for which a solution could not be found in it.

Of course there are some points that seem to call for criticism, and in making these the writer cannot but feel how much more easy it is to find fault than to do a thing well one's self.

M. Planat explains, in the preface, that he has tried to avoid all useless theory and complicated formulæ, reducing all to graphical tables, or to "*théoremes les plus simples de la géometrie élémentaire*"; facts which the frequent use of differentials would hardly bear out; and we fear that any student turning to pp. 35, 36, 292, 326, 327, or many similar ones might get discouraged at the appalling array of formulæ presented therein. Then, again, M. Planat apologizes for frequent repetitions, claiming that every chapter thus forms a whole, "making it more valuable for reference," another statement which he fails to carry out. The book would undoubtedly have been much more valuable as a reference-book had he resorted to the tedious but important practice of repeating after each formula the exact meaning of every symbol or letter. As this is not done, the value of the book as a reference-book is almost entirely destroyed. For instance, were the architect to refer to his formula for columns, p. 357, viz:

$$\frac{N}{W} = \frac{7500}{1 + 0{,}00335 \times \frac{l^2}{h^2}}$$

(there being no explanatory key), he would naturally think that the $\frac{l^2}{h^2}$ were the same as in Gordon's formula, or that h stood for the least diameter. By referring back some twenty pages, however, to page 337, he will find that h^2 really takes the place of r^2 in Rankine's formula, and stands for the square of the radius of gyration of the least diameter — quite an important difference.

[1] "*The Sanitary Drainage of Buildings;*" by William Paul Gerhard, C.E. New York: D. Van Nostrand, 1887.

[2] "*Pratique de la Mécanique appliquée à la Résistance des Matériaux.*" Par P. Planat, Directeur de *La Construction Moderne.* Première édition. En vente aux Bureaux de *La Construction Moderne*, Place Boieldieu, 8: Paris, 1887. 935 pages, quarto.

When these minor criticisms are made, however, none but praise remains for this valuable work.

There are chapters on the theory of the "deformation of pieces" in which he reduces all forces to the simple movements of an atom in the three directions, as taught in analytical geometry. Also, chapters on the exterior and interior forces (strains and stresses), tension, torsion, compression; strength of metals, woods, stones, cements, limes and mortars; moments of inertia, transverse strengths, deflections, built-in and laid-on beams, riveted girders, iron and wooden columns, iron and wooden trusses, arched trusses, spires, masonry-centres, retaining-walls, foundations, bearing-walls and arches. From this enumeration the value of the book can easily be judged, particularly when it is remembered that he adds many practical examples and tables. A detailed review of the book would take many pages. A few points, however, may be of interest.

The method of reducing many forces to a single force, as explained in Chapter I, is interesting, but very theoretical.

The next chapter, on tension, is particularly full and interesting. On page 50 is a diagram, showing, in a very clear manner, the action of iron under tension.

The following tables, on pages 51 and 52, show very clearly the amount of elongation from tension in wrought-iron and steel; also, the amount of permanent set of the metal after its reaction, when the strain is removed. He concludes that the strength in resisting tension is not proportioned to the ultimate resistance of the material, but to its limit of elasticity; that is, that certain severe strain after which the metal refuses to react. He places the safe resistance to tension of iron at 12 kilogrammes per millimetre (17000 lbs. per square inch), or in "important works" at 6 kilogrammes (8500 lbs. per square inch) — rather a large difference. In reading this work one cannot but regret anew that we have not yet adopted the metric system, as all foreign works are thus rendered practically useless to us

In the compression of stones, etc., M. Planat allows as safe but $\frac{1}{10}$ of the ultimate resistance to crushing, in ordinary stones; or $\frac{1}{6}$ if the stone is "close-grained, well cut, well laid, and not altered by exposure." In considering the difference between stones laid "on edge" or "on bed," he finds there is no practical difference, if "the stone is homogeneous, with stratifications not easily found"; but even where the layers can be easily traced, he mentions that the difference is not so great as one is "tempted to think" — a statement hardly borne out in practice. Many interesting experiments are quoted to prove that dry stones resist compression better than wet stones; in many cases stones when wet losing from $\frac{1}{4}$ to $\frac{1}{3}$ of their resistance to crushing, and in some cases even $\frac{1}{2}$ — a very important consideration in exposed places, bridge foundations and reservoir walls.

For stones, the strength of which cannot be ascertained by experiment, he suggests that their weight be compared with that of some well-known stone, and the strength proportioned accordingly, the heavier stone being, of course, the stronger.

Similarly for unknown cements, he suggests that all be passed through the same sized sieve; that a measure be then filled with each, by pouring the cement over an inclined plane, but not packing it, the heaviest to be considered the best; the finer the cement-powder the better. The sieve he recommends should have 15 meshes per centimetre, or 38 meshes per inch.

The chapter on transverse strains is very interesting and very complete. It exhibits most curiously how the political animosity existing between two nations can be carried even into the realm of science. M. Planat mentions that in German practice the strength of beams is according to the modulus of rupture, or ultimate breaking strength, whereas French engineers always use the limit of elasticity (taking $\frac{1}{2}$ thereof as safe); he then proceeds to prove how much superior is the French method, and crows accordingly. He has to admit, however, that experiments favor both methods, but accounts for this from the well-known fact that a small load often applied will gradually alter the nature of the material, or, as he puts it: "M. Tresca's experiments prove that where loads are placed on a beam and removed, the loads increasing in amount constantly, that the limit of elasticity becomes constantly greater, till finally it confounds itself with the limit of rupture; the molecular state of the metal transforms itself little by little; . . . *l'éducation du métal se fait.*"

In regard to the law of the fatigue of metals, he gives an interesting table (taken from the German), on page 102. They consider that a load of 41.25 k. per square m.m., or 58700 lbs. per square inch, can be repeated 170000 times before the beam will break; while a load of 33.75 k., or 48000 lbs. per square inch can be repeated 480000 times; one of 30 k., or 42700 lbs. per square inch 1320000 times; one of 27 k., or 38400 lbs. per square inch 403500 times; while a load of 22.50 k., or 32000 lbs. per square inch, can be repeated *ad libitum*, and will never break the beam.

Most ingenious graphical tables are given for ascertaining the moments of inertia of the various sections of I-beams, channels, tees, angles, riveted girders, etc.

By adopting a horizontal force at each end of a beam — the two forces being equal, but in opposite directions, thus counterbalancing each other — his explanation of the graphical method of calculating bending moments and deflections becomes very simple, and easily understood and remembered. The same may be said of the graphical diagrams for the gradual increase of the thickness of flanges in riveted girders.

On page 171 and the following pages, is a very explicit and able explanation of the action of the different strains or tendencies to crush, shear, turn, etc., on the hard-wood keys or wedges of spliced wooden beams.

In treating of flitch-plate girders, M. Planat gives some very peculiar sections. Instead of using a sheet of plate or boiler iron bolted between two wooden beams as we do, the French custom evidently is to take an I-beam, or riveted girder, surrounding it *entirely* with wood fitted or bolted to the beam or girder. In calculating the strength of such a structure he warns the practitioner not to apportion to the wood and iron separately their respective strengths, but to calculate only for corresponding *deflections* in all parts.

Levers and the varying strengths of beams with built-in and laid-on ends are explained, and very clear graphical solutions given. The examples of levers — and, in fact, all examples throughout — are practical, and such as are likely to be met with in every-day practice. For instance, under levers he gives very fully the calculation of the strength of corbels, columns, consoles, lintels, etc., of an "*Erker*," a species of open stone bay or covered balcony.

The chapter on columns is interesting, but rather complicated and tedious, with the exception of his explanation of the reason why rounded end columns are weaker than columns with planed ends; this is remarkably well done. He enumerates the different formulæ of Hodginson, Love, Gordon and Rankine, preferring the latter to all the others, and proving that it agrees closest with experiments. He then devotes much time to develop a theory of his own, which, after all, proves to be but a very slight modification of Rankine's formula.

The French practice in regard to the minimum thickness of cast-iron columns he gives as follows:

Columns........	2	m. long,	to be	0,010	m. thick.
"	3	"	"	0,012	"
"	4	"	"	0,015	"
"	6	"	"	0,020	"
"	8	"	"	0,025	"

or say:

Columns.......	6′ 6″	long,	should be	$\frac{3}{8}$″	thick.
"	9′ 10″	"	"	$\frac{1}{2}$″	"
"	13′ 1″	"	"	$\frac{5}{8}$″	"
"	19′ 8″	"	"	$\frac{3}{4}$″	"
"	26′ 2″	"	"	1″	"

The table for loads to be assumed on floors is rather curious:

Bedrooms..............................	250	K. per	sq. m.	or	51	lbs. per sq. ft.
Parlors..................................	350	"	"	"	71	" "
Grand Parlors.........................	450	"	"	"	92	" "
Offices...................................	350	"	"	"	71	" "
Assembly rooms......................	500	"	"	"	102	" "
Salons for grand reunions..........	600	"	"	"	123	" "
Cumbersome, but not very heavy merchandise..................	500	"	"	"	102	" "
Docks, depots, and heavy merchandise........................	1000	"	"	"	205	" "

Then follow chapters on trussed beams and girders, wood and iron trusses, riveting, derricks, spires, arched trusses, and wind-pressure, all, of course, well written, but not particularly original in matter of treatment. A very interesting chapter, however, gives the treatment of wooden centres for masonry; also the one referring to the varying strains on tie-rods, in large trusses, due to the effects of temperature, etc.

In the chapter on foundations M. Planat develops some very curious — rather than practical — theories on the compression, and tendencies to shearing, upwards sliding, etc., in compressible soils.

He makes an attempt in the final chapters to treat of masonry, and particularly the thickness of walls, but there are no new rules developed, nothing but the old French rule-of-thumb methods. It is curious that, considering their importance, so little has been done towards ascertaining some exact methods of obtaining the bearing strength of walls and their resistance to bulging. M. Planat develops some curious ideas on this subject: according to his book, off-sets are unknown to him, and all walls must be gradually battered where it is necessary to diminish their thickness. He analyzes three different sections of wall, each of equal amount of material in cross section; the first with both faces vertical; the second with one face slightly battered, and the third with one face very decidedly battered. He finds the last the strongest, but thinks the expense of the ground occupied more than off-sets its value. The second he thinks stronger than the first, but that the expense of battering would off-set the amount of the material saved. On the whole, he inclines to the first method of keeping the same thickness and amount of material in a wall from top to bottom. He next shows graphically the bad effects on a wall of building beam-ends in solidly. The last chapter is on arches and vaults, embodying the usual rules.

In conclusion, if the writer were to be asked by any student how he could best acquire a good knowledge of strains, he could recommend no better course — providing, of course, that the student could read French — than to set to work and carefully translate M. Planat's book.

Telephone Wires. — Telephone wires in Germany are generally made of steel, being considered more durable when of this material. This supposition was fully confirmed after a recent snowstorm, as steel wires were found to have scarcely suffered any injury. The results of the investigations of the general authorities on the matters of the telephone wires, occasioned by the same snowstorm, have just been published. It is found that phosphor-bronze wires are of but little worth; steel showed very favorable results, but those of silicium bronze were proved to be very far the best in every way. — *Invention.*

COMMUNICATIONS

ARCHITECTS RESPONSIBLE FOR COMPETITIONS.

JOLIET, ILL., June 21, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs. — The following is an advertisement lately received, from which can readily be seen what our Western people have been educated up to. They go by the old adage "Ask and ye shall receive," and they, no doubt, will receive many plans from men who do not value their time or talent. It is not the fault of those who ask and expect a score of architects to submit an aggregate of $10,000 worth of work and information, that they may feed upon the same and finally use their reserved right and reject all plans, after having their chosen political architect or some one else make tracings of the best feature of each and combine them in one.

The fault lies with our own profession; if a few such invitations would go totally unheeded by the architects it would not be long before the public would learn that to obtain good talent in competition they must give some substantial assurance that at least some two or three of the competitors are going to be paid for their trouble, even though all plans be rejected. They would soon adopt the prize-system, and would undoubtedly receive in competition the thought and knowledge of the best of architects, which would, no doubt, be much better for them as well as ourselves. This seems to be a sort of missionary work that should be taken up by our societies and something done to prevent it; good public buildings should be well designed and well built, as they will reflect credit or discredit on the architects of this age for centuries to come. The remedy may come in a higher education of the masses, but I think more quickly and more substantially in a higher education of our own men. Architects should be educated up to a standard where they would consider it a disgrace to go into such a competition, and until then it is doubtful if the end can be reached; however, I would be glad to hear from other members of the profession on this point.

Very respectfully yours, F. S. ALLEN.

[THE advertisement referred to calls for plans, specifications and estimates for a $170,000 Court-house, and "reserves the right to reject any and all plans," and, moreover, states that "no compensation will be paid for any plans except those adopted by the commissioners." — EDS. AMERICAN ARCHITECT.]

A WIND-SHAKEN HOUSE.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs. — Will you be good enough to furnish an occasional reader with some information on the following points: Is a dwelling-house, of brick — walls thirteen inches all the way up, two full stories with third story in steep pitched gable — that shakes or thuds occasionally in a very violent wind, to be considered safe? The house is cruciform in shape, with four wings, averaging each eighteen feet in width; situated on top of a hill in an exposed situation; otherwise a well-built house, joints between bricks well slushed with mortar, and floor-joists throughout twelve inches. It is more of a concussion than a shaking, in a very high wind. In general, is a house stoutly built that is at all jarred in a very high wind? The occupants of some very large houses, situated, however, in an exposed place, complain of the same thing. Your opinion in the matter will be gratefully received.

[IT does not seem as if a house of the shape described would be in danger from ordinary high winds. A perceptible shaking would not necessarily be a serious matter, unless it should be followed by the opening of joints in the brickwork. — EDS. AMERICAN ARCHITECT.]

INFORMATION WANTED.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs. — Can you kindly tell me in what number of the *Saturday Review* I may find the article spoken of in an editorial on "The next Examination for the Rotch Travelling-Scholarship," printed in No. 587, April 2, of the *American Architect.* The article I want to find in the *Saturday Review* is the one speaking of the recent exhibition of water-colors in London by Mr. Mead. I have looked over all the *Reviews* since January 1, 1887, and cannot find it, so trust you can help me.

Yours truly, M. C.

[WE got our information about the article in the *Saturday Review* at second-hand. Perhaps one of our readers can give the reference. — EDS. AMERICAN ARCHITECT.]

AMERICAN ARCHITECTURAL SCHOOLS.

RACINE, WIS., June 20, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — Will you kindly publish names of some of the best architectural schools, with name of proper persons to address for information in each case? Yours truly, E. H. PRICE.

[MASSACHUSETTS INSTITUTE OF TECHNOLOGY, Boston, Prof. T. M. Clark, 178 Devonshire Street, Boston; Columbia College School of Mines, New York, Prof. W. R. Ware; Cornell University, Ithaca, New York, Mr. E. F. Osborne; Illinois Industrial University, Champaign, Ill., Prof. N. C. Ricker, Urbana, Ill. — EDS. AMERICAN ARCHITECT.]

PITTSBURGH, June 15, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — Can you give me an idea of the total cost of a two years' special course in architecture at the Massachusetts Institute of Technology. Please answer through your journal, and oblige

ARCHITECTURAL STUDENT.

[Two hundred dollars a year for tuition; books and materials twenty or thirty dollars a year; board and personal expense from four hundred dollars a year upward. — EDS. AMERICAN ARCHITECT.]

NOTES AND CLIPPINGS

RATS BREAK UP A MINING STRIKE. — It is during a strike in the mines, when the workings are abandoned for the time, that the mine rats are especially annoying to mining villages. The rats leave the mines then and swarm about the dwellings of the workmen. I remember once there was a strike at one of the collieries. Both operators and miners refused to give in, and the bosses declared that grass would grow around the mouth of the slope before they would consent to the demands of the men, while the men swore that they would cut the grass and eat it, if it was necessary, before they would yield a single point. The mules were taken from the mines and turned out to pasture. The rats, being thus deprived of their sustenance, abandoned the mine and took up their quarters about the miners' houses, where they became a terror to the families. The strike continued, and the supplies of the men became exhausted. Miners at neighboring collieries who were at work responded to the requests of their striking brethren for aid, and sent them a wagon-load of supplies of various kinds. These were taken in charge by a committee and stored in a building, from which they were to be distributed to the neediest of the miners. The first night the store was raided by the rats, and everything devoured or carried away. Four different loads of supplies were furnished in this way, but the rats got the biggest share of them. A good many of the miners kept cows at that time, there being plenty of free pasturage about the place, but soon after the strike began the cows began to lessen their yield of milk. This could not be understood, until one morning a miner went to his barnyard and discovered half a dozen big rats sucking the milk from his cow as she lay on the ground. These combinations against them at last forced the strikers to weaken, and they finally went to work on such terms as they could obtain, absolutely beaten by the devouring horde of rats. — *New York Sun.*

WATER-RAMS IN STEAM-PIPES. — Mr. Charles E. Emery, chief engineer of the New York Steam Company, in one of his recent lectures on "The Transmission of Steam," refers in an interesting manner to water-rams in steam-pipes. In the April number of the *Stevens Indicator* Mr. Emery is quoted as follows:

The principal cause of accidents in the operation of large, long steam-pipes arises from the presence of water. If steam be admitted at the top of a vessel partially filled with cold water, condensation will take place until the surface is somewhat heated, and this, in connection with a cloud which forms above the surface, will retard rapid condensation, so that, in due time, the full steam pressure can be maintained above water cold at the bottom. This phenomenon is not an infrequent occurrence in boilers in which the circulation is defective. It is, therefore, perfectly safe to heat up any vessel containing cold water, if the steam can be admitted from the top upon the surface of the water and so maintained. If, however, steam be blown in below the surface of the water, a bubble will be formed, which will increase in size until its surface becomes sufficiently extended to condense the steam more readily than it can enter, when a partial vacuum will be created, the bubble will collapse, and the water flowing in from all sides at high velocity will meet with a blow, forming what is called a water-ram. In blowing into a large vessel, these explosions occur in the middle of the mass, and create simply a series of sharp noises. If, however, steam be blown into a large inclined pipe full of water, it will rise by difference of gravity to the top of the pipe, forming a bubble as previously stated; and when condensation takes place, the water below the bubble will rush up to fill the vacuum, giving a blow directly against the side of the pipe. As the water still further recedes, the bubble will get larger, and move further and further up the pipe, the blow each time increasing in intensity, for the reason that the steam has passed a larger mass of water, which is forced forward by the incoming steam to fill the vacuum.

FIRES IN PARIS. — The returns showing the number of fires which occurred in Paris during the year 1886 have just been published, and the total was 953, this being exclusive of 1,524 chimneys on fire. This is a larger total than has been recorded for several years, and among the calls for fire there were no fewer than 13 in theatres and cafés-chantants, these being the Vaudeville, the Opéra Comique, the Hippodrome, the Odéon, the Porte St. Martin, the Eden Theatre (twice), the Opéra (twice), the Château d'Eau, the Théâtre de Paris, the Padro and the Bataclan. The three months during which there were the most fires were January, November, and December. The total amount of damage done by the 953 fires is estimated at about £248,000, and in 842 cases the loss to property was covered by insurance, but the furniture was insured in only 640 cases. In 407 cases the fire was extinguished without having recourse to the engines, and in many of the other cases they were not wanted when they reached the scene of the fire. No fewer than 107 of the fires were caused by the upsetting of lamps, while only 10 are attributed to incendiaries. No lives were lost during the year, either among the inhabitants of the houses where the fires occurred or among the fire-brigade, which at present consists of

1,754 men, including 51 officers, who are quartered in 11 different barracks, a twelfth being now in course of construction. Each barrack is provided with a hand-engine and two pumps, carrying about 650 feet of hose and an escape-ladder, a ventilator to be used when the fire breaks out in a place full of noxious gases, and safety-lamps of various patterns. There are also 11 steam-engine depots in Paris and 85 lookout-posts, of which 62, each with two, three, or four men, are in the theatres. The length of the telegraph-wires connecting the different stations is about 350 miles —*London Times.*

Death by Electricity. — A number of interesting experiments have just been made with such electrical machines as are employed in industries, with the view of determining under what conditions they may become dangerous. These have been conducted by M. D'Arsonval, who has already established the fact that what is truly dangerous where these machines are used is the extra current that occurs at the moment the current is broken, and in order to annul this extra current he proposes to interpose a series of volta-meters containing acidulated water along the conducting wire. The new arrangement now employed is at once more simple and efficient. It consists of a V-shaped tube made of an insulating substance, which, after being filled with mercury, is interposed in the main current. In order to close the latter it is only necessary to turn a tap, which is arranged similarly to the tap on the gas-pipe. In this way the machine is unprimed without its being able to give an extra current spark. Another arrangement is also made use of, a glass tube being filled with mercury and dipped into a reservoir containing the same substance. The tube is provided with a ground stopper, this not only permitting the suppression of the extra current but also interposing any sort of resistance to the current. Although these details appear rather technical, they relate to a most important matter. The use of electrical machines is increasing, and it is of practical use to know that currents are not dangerous until a power of 500 volts is reached. It is also of interest to know that the mechanism of death varies with the nature of the electricity used. Thus, with the extra current, or with alternating currents, there is no anatomical lesion, and the patient can usually be brought back to life through the practice of artificial respiration, as employed in cases of drowning. The discharge of static electricity from batteries, on the contrary, causes a disorganization of the tissues that renders fruitless all attempts to restore life. — *London Times.*

Portland Cement and Sea-Water.— An important point as to the behavior of Portland cement when subjected to the action of sea-water has arisen at Aberdeen, where the Harbor Board recently requested Professor Brazier, of Aberdeen University, to analyze samples of briquettes of the Portland cement used in the construction of the graving-dock, and also samples of the concrete taken from the entrance-walls of the dock. Professor Brazier's report was received on Monday, and states that a chemical action had taken place between the sea-water and the Portland cement in the concrete, causing an expansion and softening of the concrete, the lime of the cement becoming dissolved and producing a precipitation of magnesia, and the lime becoming more or less carbonated. It would appear, the Professor states, that Portland cement has not sufficient power to resist the action of sea-water. The harbor engineer also reported that the Portland cement concrete entrance-walls of the dock had expanded 2¾ inches in the height of the walls, their surfaces had cracked and bulged, and the joints of the caisson quoin-stones had opened up, causing considerable leakage. Repairs were suggested by the engineer at an estimated cost of £900. The reports are to be considered in committee. — *Building News.*

Illuminating Streets by "Smoke."—When William Murdoch made his discovery of combustible air, or gas, even great and wise men laughed at the idea. "How could there be light without a wick?" said a member of Parliament, when the subject was brought before the House. Sir Humphry Davy ridiculed the idea of lighting the town with gas, and asked one of the proprietors if he meant to take the dome of St. Paul's for a gas meter. Sir Walter Scott made himself very merry over illuminating London "by smoke," though he was glad enough, not long afterwards, to make his own house at Abbotsford light and cheerful on wintry nights by the use of that very smoke. When the House of Commons was lighted by gas the architect imagined that the gas ran on fire through the pipes, and therefore insisted on their being placed several inches from the wall for fear of the building taking fire. The members might be observed carefully touching the pipes with their gloved hands, and wondering why they did not feel warm. The first shop lighted in London by this new method was Mr. Ackerman's, in the Strand, 1840; and one lady of rank was so delighted with the brilliancy of the gas lamp on the counter that she asked to be allowed to take it home in her carriage. — *Invention.*

Ancient Chinese Bas-Reliefs. — An English traveller, who has been inspecting certain ancient bas-reliefs near Chia-siang, China, in a chapel built in the second century and lately freed from the accumulated earth of ages, reports that the aim of the Chinese sculptors was largely to inculcate morality. Thus a wife who allowed an enemy to cut her head off, supposing it to be that of her husband, is depicted. Another purpose was "to picture the wild and incredible in nature, and certainly the view here given of the monstrous beings which the people of China then thought of as existing in earth, air and seas is confirmed by the books which remain from that age. Another prevailing aim was to bring good fortune to the descendants of those buried in the tombs by depicting lucky plants, lucky clouds, lucky animals, and favorably-disposed divinities." These sculptures are supposed to be the same that are described in the antiquarian book written in Chinese, and belong to the epoch 400 B. C.–200 A. D., when bas-reliefs of the kind flourished. In front of the chapel are pillars carved with grotesque door-keepers in the shape of eight-headed human tigers, three-bodied human monsters, and other figures designed to keep off evil spirits.

Coke for Vault-Filling. —The use by old Roman architects of volcanic scoriæ or pumice as a filling-material for vaults and spandrels is a practice that might be profitably copied in our own day. The vaulting of the corridors of the amphitheatre at Catania is so executed, and so is the dome of the Pantheon at Rome. These structures have stood the sieges, earthquakes, and various other causes of damage and decay for many centuries. Coke is a somewhat similar material, and might be used as a substitute for the often rare pumice. — *Engineering News.*

A Statue of Salmon P. Chase.— There lies in a store not far from Charles Street a valuable historical relic, which would gladden many admirers of the late Chief Justice Chase did they possess it. It is a statue, heroic size, with pedestal, of the late Salmon P. Chase, designed by Clark Mills, the sculptor, who contracted to furnish the government with seven statues, made from captured cannon, and of these this is one. Had the statue been polished, the death of the sculptor, which occurred shortly after its completion, would not have acted as a bar to its delivery to the government. In the course of a business transaction this valuable work of art found its way to its present quarters, where it is secluded from public observation. — *Baltimore American.*

TRADE SURVEYS

Both American and foreign markets are firm in tone under a steady expansion of trade. The signs in commercial and financial circles are briefly these: Light stocks, steady demand, large orders, sufficient money, confidence and a moderate indebtedness on the part of the producing interests. The main industrial features this week are, a steady distribution on old orders, increasing new orders, numerous inquiries, favorable returns from large consumers, and exhausted condition of stocks among buyers. Whether we look at consumers of cotton, wool, iron or lumber, or at the uses of such manufactured products as cloth, furniture, hardware or machinery, it is evident that the users are scantily supplied rather than abundantly. From the forthcoming distribution of trade catalogues it will be shown that the shop and mill-producing capacity of the country has been greatly extended within six months in view of what all confidently believe will be the best season the country has ever had. The enlargement of lumber markets in a half dozen States of the Northwest has made prices in Michigan firm. Within a few days an advancing tendency has been noted which Eastern dealers and builders would do well to notice. A sort of combination is being attempted in white pine, and the first step is to stop a useless cutting of prices that has been going on. It may sound strange in view of the enormous lumber cut in the East, Northwest and South, to intimate that higher prices are probable or even possible, but let a few facts and conditions be kept in mind. Rates have been advanced by rail and lake — vessels, for some reason, are not plenty enough to keep prices down. The far West is absorbing an enormous amount. Dealers West are beginning to order ahead, just as Eastern dealers did last spring. Lumber manufacturers are holding their heads together better. Drystuff of all kinds is scarce. Every cargo and car-lot of lumber has thus far found a ready market and stocks in first and second hands are merely nominal. Recent lumber contracts at New York call for some 35,000,000 feet of stuff, of which one is for 5,000,000 feet of hemlock for the Poughkeepsie bridge, 2,000,000 for the Harlem bridge, 2,000,000 for Arthur Kill bridge, 15,000,000 feet for aqueduct work, 5,000,000 feet for elevator work, besides other orders. The export trade in lumber is quite an item, and is helping to strengthen prices. Last week 31 clearances were made from New York of 1,855,657 feet of lumber and 131,000 shingles for the West Indies and South America. Other minor facts and considerations might be adduced to show buyers of lumber that it is advisable to keep one eye on the lumber market. In other directions there is much that is interesting to note. The Western iron association, representing 150 rolling-mills, quietly conceded the ten per cent advance asked, and are repairing their hot furnaces to rush into the fall trade. The importation of over a half million tons of foreign iron and steel shows that, as yet, we have not exceeded the safe-producing limit, and even our ore mines are unequal to the demands made upon them, for the ore importations are over a half million tons, although special causes are behind this fact. Then, again, there are inquiries in for large lots of foreign steel rails, and one order for 10,000 tons, which was taken for Gulf delivery at $40.50. Buyers are taking the initiative in all channels of trade, and this is the most encouraging fact of all. Sellers are anticipating an improvement in prices, and are therefore not crowding after business, being content to take what comes, and nurse their opportunity. The favorable crop reports and the prospects for strong prices are strengthening the position of tool, implement, stove, and machinery makers both West and East. Within two weeks it is probable that raw material of nearly all kinds will be in demand for the autumn months. The New England textile manufacturers, paper-makers, boot and shoe makers, and other large interests have evidence before them already of the healthy character of the fall trade. Pessimists are driven on account of the scarcity of material to make capital out of the growing treasury surplus, and to predict damaging consequences on account of these accumulations. The first damage done will be by the action of the money-lending interests when pay-days for money loaned passes. The extraordinary investments in the South and the great outlay in the Western States make danger in this direction probable, but if it comes the change will be merely in the title to the property. The improvements will remain.

Building activity will not slacken. A new shower of permits is probable. Architects in Chicago, St. Louis, and Cincinnati speak very encouragingly of the prospects of building, and reiterate previously-expressed opinions as to the permanent value of investments. Commercial failures are few and the amounts comparatively trifling. Collections are easily made. Merchants and manufacturers have but few bad debts, and banks are called on less frequently than in former years to help out unfortunate customers. The situation at this date is such as the most exacting merchant cannot help but feel is safe. The thousands of new firms, companies and corporations who are entering production and exchange on the high tide of prosperity have only to remember that there are as many breakers ahead in 1887 for the next five years as there were in 1882, and since then 50,000 commercial houses have gone under. The newer competitors for trade and business are wisely guarding against disaster by making stronger combinations, by using heavier machinery, and by adopting a multitude of little economies in the conducting of business which are not ordinarily within the reach of men or concerns of limited means.

THE AMERICAN ARCHITECT AND BUILDING NEWS.

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CONTENTS

IT is a great pity that the public departments devoted to preparing Statistics of Labor which now exist in many of our States cannot, if they are necessary at all, be put in charge of some one capable of managing them with some profit to his fellow-citizens. We acknowledge that we have a great distrust of statistics in general, and of all statistics, those relating to the characters and lives of people whose education has not fitted them for comprehending questions clearly, or answering them directly, or for telling the exact truth without ornamental additions, are the least to be believed in; and when, as seems to be usually the case, the collection of such information is left to persons who supply from their imaginations the facts which they have forgotten to collect, or generalize on the most important points from two or three bits of doubtful evidence, or who dislike to take the trouble to ask questions, and content themselves with getting their knowledge out of newspapers, the result is about as worthless as anything in the form of statistics could well be. We remember a case where a State statistician undertook to investigate the moral character of factory-girls in the community which paid him for his labors. Journeying to a certain manufacturing town, instead of betaking himself to the chief-of-police or the physicians, who could between them have given him a pretty clear idea of what he wanted to know, he asked, apparently, the first two men that he met, what was the moral character of the factory-girls of the town. The first man answered promptly that they were no better than prostitutes. The second replied that they were just as good as any other young girls, and the statistician retired with these two pieces of information to add them together and divide by two, and tabulate the result as the moral condition of the gentler sex in the fourth or fifth city of the State.

AN official of a similar stripe has been composing some disquisitions upon "Boy and Girl Labor" in another State, based, apparently, upon his reading of the advertisements in the New York *Herald*. In this journal he finds a large number of advertisements for boys, or for young men not over twenty-one or so, while comparatively few advertisers express their preference for old men, and he argues from this circumstance that an "appalling" competition for employment exists between the boys and their seniors. As "two or three half-fledged apprentice-boys will affect the living and wages of a skilled mechanic," the "skilled mechanic," unless he has sons of his own whose future he wishes provided for, tries to prevent their employment, and in consequence of this, as we think, rather than of the "want of aptitude" with which the commissioner reproaches the apprentices, they "go knocking about from one place to another," and finally, in many cases, get knocked out of the State altogether, "wandering wherever they hear of a chance to pick up a living." It would be interesting to know what the commissioner would recommend as a method of disposing of young men of twenty-one, to prevent their "appalling" influence upon the fortunes of the older men who want to keep all the work and wages to themselves. No doubt it would be delightful to have them all sent to college and kept there until the plumbers considered them of suitable age to begin learning a trade, but there would be bills to pay in this case, and the commissioner points out no means for meeting these and for supporting the younger brothers and sisters meanwhile. In fact, the whole essay, which the State pays for having written, printed and bound, appears to be a sort of rambling, purposeless discourse, inspired, if it could be said to have any inspiration, by the newspaper accounts of the effort of the plumbers last year to prevent boys from learning their trade, illustrated by some feeble inferences from newspaper advertisements, and confused with a dozen other matters, among others, with the prevalence of "single women" in the large cities, which the commissioner attributes to the employment of boys in stores and factories. It is sad that public money should be wasted on such trash as this, but for the moment all politicians stand in mortal terror of Labor, with a capital L, and seem to be ready to vote for any appropriation the title of which contains the magic word.

THE great competition for the rebuilding of the front of Milan Cathedral has been brought to a close by the selection of the design of Ferdinand Becker of Mayence. Taken altogether, this seems to have been one of the most interesting competitions of recent years. A great deal of latitude was allowed to the designers, and all facilities were afforded themf or studying the history and style of the building which they proposed to improve; while, last, but most important of all, the decision was entrusted to a jury of the most distinguished experts in Europe. This assurance of an intelligent judgment seems to have proved a great attraction to architects, and one hundred and fifty designs were submitted, by one hundred and thirty competitors, many sending alternative plans. The most extraordinary diversity, as we learn from the foreign journals, existed among the plans. It is hardly necessary to say that nearly all the designers proposed to complete the purely Gothic building by a façade in the same style; but one architect attracted attention by an attempt, which was not without considerable success, to exalt the present commonplace Renaissance front into a portion of a very noble composition, by building beside it a splendid Renaissance campanile. As a rule, all the designs, whether in Classic or Gothic style, comprised towers of some sort. One plan proposed to give dignity to the front by accenting it with two spires, each nearly seven hundred feet high; while another showed no less than nine towers of various dimensions. The preliminary selection included plans by English, French and German, as well as Italian architects, and curiously enough, the final choice fell upon an architect belonging to a town which is almost destitute of examples of good Gothic architecture, although it possesses one of the most beautiful buildings in the world, in its German Romanesque cathedral. We are sorry to have to add that the Milanese architects, or at least a considerable party of them, bore with anything but a good grace the decision which gave the palm of victory in an honestly managed, and well-fought contest, to a foreigner. Immediately after the award a rather excited meeting was held, in which the hastiness of the decision was denounced, and a demand was made upon the Royal Commissioner of Public Works to annul the work of the jury. It is not at all likely that the Commissioner will do anything of the kind, least of all on the pretext that too hasty a judgment was given upon plans which the local members, in Milan, who formed a large part of the jury, had for months had before their eyes; but the affair gives an unpleasant turn to what would otherwise have been an interesting chapter in the history of art, and we hope that the good feeling of the other Italian architects, who need not fear comparison with those of any country in the world, will lead to a prompt repudiation of the action of a disappointed faction.

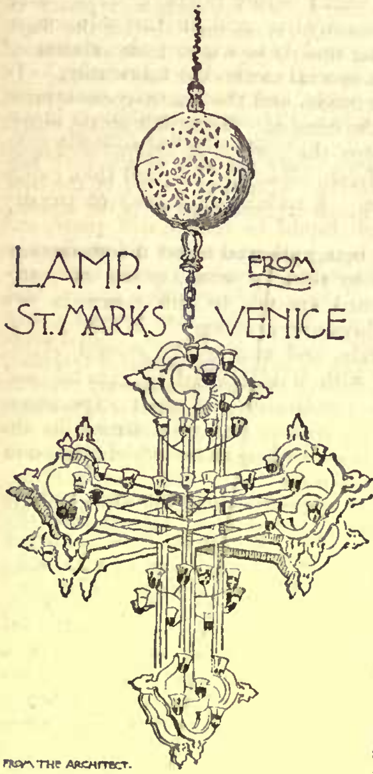
WE do not doubt that we have many sympathizers in our ill-will toward the samples of tin, stamped and guaranteed in a somewhat ferocious rivalry, which come to us through the mails with irritating frequency. Having already studied the stories of the contending manufacturers, we do not feel that we should be further enlightened by renewed inspection of the bits of metal, and as these cannot be burned up, and are rejected by the paper-stock collector, they accumulate, taking up room which few offices can afford to spare them. If one had time, however, to compare these specimens of the best modern tin-plate with sheets ten or twenty years old, the difference in quality would strike the most careless observer. Most

of us remember the tin-plate of our youth, with its surface diversified at one end with drops and streaks, where the bright coating solidified in the act of dripping off, and can understand the imperfections of such a product as compared with the smooth, uniform sheets of the present day, rolled between polished rollers after undergoing their bath of tin, and showing a surface nearly as finished as a mirror; but the greatest improvement ever made in the manufacture is perhaps the less obvious one introduced about seven years ago, when the soft open-hearth steel was generally substituted for Swedish iron in making the plates. The modern methods of working tin, by stamping in place of soldering pieces together, demand plates of the utmost ductility, and the Siemens-Martin steel, while easily and cheaply produced, not only equalled the pure Swedish iron in this respect, but gave sheets which were, with an equal weight, both stronger and smoother than those of iron, requiring, for a given purpose, less iron and less tin than the old plates. Within a short time, the Thomas-Gilchrist steel, made by a process similar to the Bessemer conversion, has been substituted for the open-hearth steel; but the value of this change is not yet entirely settled. Of iron and steel of all kinds, according to the *Revue des Mines*, the tin-plate makers of England now consume four hundred and sixty thousand tons a year. At a rough calculation, this would be enough to roof over a shed extending from New York to Liverpool, and wide enough for the "*Etruria*" and the "*Umbria*" to pass each other at any point, with room to spare; but it seems that a very large part, instead of being used for roofing, which is an exclusively American method of employing the material, is consumed in making cans for preserving meats, fruits and vegetables. Of these the number turned out is so enormous as to be almost beyond belief. In 1885 eight hundred and seventy-five millions are known to have been made, and there may have been millions more, which escaped counting. Next to the reflection as to what all these contained, the most interesting inquiry which this piece of statistics suggests is what becomes of all the empty cans. Millions of them are thrown into the sea, and sink, or are cast on desert shores; and millions more find their way to the rubbish heaps which fill low lands and excavations, but there are still myriads unaccounted for. In Egypt, it is said that the Arabs pick up the large rectangular cans in which coal oil is exported to them, fill them with sand, and build very comfortable houses with them, but the cylindrical can does not lend itself very well to architectural purposes, and the world still awaits the inventor who shall tell it how to utilize to advantage the cast-off evidence of modern civilization.

LA SEMAINE DES CONSTRUCTEURS, in reply to a correspondent who asked for the recipe of a cement for repairing the worn places in stone steps, gives the composition of the famous "*ciment Sorel*," which has for many years been used by a few contractors, who make a great secret of their process, for filling cavities and restoring abrasions in stone or marble. The first person to use the cement, Sorel, was the inventor of the so-called process of "galvanizing" iron, by covering it with a protecting film of zinc. In the course of his experiments he found that the oxide of zinc, mixed with a solution of the chloride of the same metal, gave a substance which soon became in air as hard as marble; and with slight variations, this mixture is the one employed by all his successors. Sorel, in practice, either used the washed residues from the manufactories of zinc white, which are perhaps heavier and less pure than the white pigment, or heated the ordinary zinc white of commerce to redness to increase its density, upon which the hardness of the cement depends. This, when intended for use, he mixed with a rather concentrated solution of chloride of zinc, having a density of fifty to sixty degrees by Beaume's hydrometer, usually adding about three per cent of borax or sal-ammoniac to lessen the rapidity of setting. So prepared, the "*ciment Sorel*," after setting, soon becomes as hard as marble. It adheres very strongly to stone, and resists heat, cold, moisture, and even the action of acids, and may be colored. To reduce the cost, and assimilate it to stone, powdered granite, marble or hard limestone may be mixed with it, but soft earthy substances should not be used. As at present manufactured in Paris, various additions are made to the powdered zinc oxide, to give certain colors or textures, and the chloride solution is sent separately in bottles, the price of the whole, ready for mixing, being about seven cents a pound. The basis of the cement is in all cases the same, some trifling differences in the mode of preparation, such as washing the zinc white with water containing borax before calcining it, or using protochloride of iron, or chlorohydric acid, in the solution, in place of zinc chloride, serving mainly to support the claims of particular manufacturers to a special method of fabrication. In general, the heavier the zinc oxide, and the more concentrated the chloride, the stronger is the cement. To repair stone, either in the shape of statues or steps, the portion to be operated upon should first be scraped to a fresh, clean surface, and then moistened with the liquid chloride. A sufficient quantity of the dry cement is mixed with enough liquid to form a stiff paste, and placed in position, and after being allowed to set a few days, is trimmed off, and smoothed by rubbing with a piece of stone. In summer, it will become hard enough to rub down in two days; in winter five or six days are necessary. While setting it must be protected from rain, and two weeks should elapse before a staircase repaired with it is opened to general use. Some of our readers, whose recollections of their experiences in the dentist's chair are fresh, will probably be struck by the similarity of the operations described to those which the dentist goes through in repairing a large cavity with cement filling, and in fact the cement used by dentists is nothing else than the "*ciment Sorel*," prepared with care for their purposes.

TWO rather remarkable discoveries are said to have been made recently of objects belonging to the most ancient period of Greek, or, perhaps we ought to say, of Pelasgic art. In one case a Turkish dervish, living at Bournabaki, near what Dr. Schliemann supposes to have been the site of ancient Troy, opened a stone tomb, and found in it a gold crown, of heavy, foliated design, a girdle, three inches wide, with a clasp, all of solid gold, and two golden rods or sceptres. Independent of their archæological value, the weight of metal contained in the different pieces is sufficient to make the finder a comparatively rich man, and all the tombs in the neighborhood will probably be ransacked without delay. Judging from this treasure, which dates, apparently, from the period before the Trojan war, the Pelasgic inhabitants of the eastern coast of the Mediterranean must have been a rich and luxurious people; and many other evidences tend to show the same thing. To say nothing of the multitudes of gold ornaments found by Dr. Schliemann at Mycenæ, explorations in other places connected with what used to be called the mythical history of Greece have been fruitful in rich discoveries. Not long ago a tomb, belonging, apparently, to the prehistoric, or Homeric period, was opened at Dymenion, near Volo, in Thessaly, far from the seat of the Pelasgic power in Argolis, and in it was found what is said to have been a countless number of objects, mostly ornaments for women, and in great part of gold. The patterns of the ornaments, of which there were many hundreds, were mostly suggested by leaf and flower form, and closely resembled in style those found by Schliemann at Mycenæ; but, besides the objects of simple wrought gold, many were found set with pearls and precious stones. Each of these discoveries, which now follow each other rapidly, must certainly increase the curiosity of archæologists to know more of that strange race which once filled Asia Minor, and apparently all Southern Europe, with its wealth and industry, and then disappeared by what all tradition asserts to have been a series of manifestations of superhuman agency. If we had simply to think of the people of Argolis and Troas as an ingenious, industrious, common-place race, like ourselves, we should be interested in their history, but nothing more; but what we are told about them gives them the character of having been on the most familiar terms with supernatural beings. One of them, who, if all the history we know about him is true, probably wore some of the ornaments dug up by Dr. Schliemann at Mycenæ, served up one of his relatives at a dinner-party, thereby incurring the anger of a divine guest; another, in the last years of Pelasgic prosperity, was appointed judge in a contest of beauty among the three principal goddesses, and a third, travelling about the world after the extinction of the power and industry of his race, was invited to a banquet by a lady, who, resenting the imperfect table-manners of his suite, turned them all into pigs by a wave of her hand. So long as no actual trace was known to exist of these personages, the legends had hardly more than an artistic interest; but after finding the remains of Agamemnon, the great-grand-son of Jupiter, covered with the ashes of the palace in which he, together with Cassandra, the beloved of Apollo, was murdered by Clytemnestra, the niece of the Swan, one is brought pretty close to the gods and heroes, and it is impossible not to desire a clearer view.

NOTES OF TRAVEL.—BUFFALO.



With many people Buffalo is thought of as pertaining to that vast, indefinite portion of the country comprehensively designated as "the West," a term implying a certain amount of breezy individuality and an unlimited quantity of pluck, enterprise and ambition. But Buffalo is really no more in the West than is our own city of Boston, for do we not speak of going "down East" when contemplating a journey to Portland or Nova Scotia? The line between East and West, Detroit people tell us, lies just beyond their city, while Chicago is very emphatic in claiming Eastern attributes, and so on across the entire continent East and West are doubtful terms, until even in San Francisco, a man will speak of "going West." But if Buffalo belongs to the East by virtue of its geographical position, it is even more Eastern in its appearance; not that it is lacking in energy or enterprise, but somehow it has to a stranger a quieter, more substantial, less commercial air than one might expect. An over-abundance of large comfortable dwellings, a minimum of wooden shanties, and an amount of business which seems so exceedingly small by comparison with the really large population that one is led to speculate as to where the people get the money to build so many fine houses when they have so few business-blocks of any importance. And again, the well-kept streets, the neatly-planted gardens with which most of the houses are surrounded, the apparent absence of the handiwork of the speculative builder which has been such a blot on the beauty of more westerly cities, and the close lines of thick, green foliage embowering nearly every street, all combine with the bright sunshine and the fresh, clear atmosphere to give Buffalo an appearance not unlike that of New Haven. It goes without saying, that Buffalo is a pretty city, and this too, notwithstanding the fact that, as with so many of our American cities, both East and West, the natural advantages of site have been quite neglected, the finest streets being away from the lake, and the water-front being so little esteemed that we doubt if one stranger in ten would ever appreciate from any ocular demonstration that Buffalo is situated on Lake Erie.

The commercial architecture of Buffalo is commonplace when it is not hopelessly bad, and, with a very few exceptions, only excites a vague wonder why the very presence of such work is not enough to prevent the erection of any more of the kind, for, notwithstanding the old proverb about the lessons which experience teaches to all but the simplest-minded, the new work is quite as bad, if not worse, than the old. There is a good street-front, No. 290 Main Street, a single arched opening in brown sandstone extended through two stories, crowned by a high billeted cornice and filled-in with a sober-toned copper bay; a front of very modest dimensions, but broad in its treatment, and worthy of better surroundings. The only drawback is that it is built over a wide, cavernous show-window—perched, as it were, upon a huge sheet of plate glass, practical considerations having demanded that entire absence of apparent support which is such a hopeless feature of the typical street-front. Then there is a good front in moulded brick just completed on Seneca Street near the railroad station, but these and a few others of the kind are exceptions, most of the commercial architecture being quite uninteresting.

The same cannot be said, however, of the public buildings. The City-Hall, while not a structure of decided originality, is a simple, dignified design, pleasing if only from its quiet mass. The details are, perhaps, neither well-chosen nor intrinsically good, but they are unobtrusive as the building is usually seen from across the square, and with its picturesquely-grouped turrets and chimneys, it strongly recalls a delightful old town-hall and belfrey in the quaint Belgian city of Courtrai, which has been sketched and admired by so many generations of architectural wanderers. It is built of stone, a gray granite if we remember aright, and thus has an added value, for try as we will, brick can never have such a dignified, monumental appearance as honest stonework. But that brick can still be used to advantage in even a large public building is abundantly shown in Buffalo by the example of the Public Library building, recently built after the design of Mr. Eidlitz, of New York. It occupies the best site in the city, an irregularly-shaped lot facing the principal square. It is built entirely of brick and terra-cotta of a uniform dark cherry color, the more striking in effect, as the square in front of it is one of the few spots in Buffalo where foliage is not abundant, so that the Library building stands out in very vivid color under the glare of the sunlight. The design is Romanesque, or Norman perhaps more properly, in general design, with enriched round arches, foliated belt-courses and cornices, and a general profusion of detail which would seem over-done were the design executed in stone; but somehow when terra-cotta is used we expect more freedom, a greater "swing" in detail and richer lines than would be admissible in any other material, and especially when, as in this instance, the entire design is in a single color, from ridge-cresting to water-table, it will stand an almost indefinite quantity of moulded ornament. The building is perhaps not monumental in the truest meaning of the expression, but it is delightfully picturesque in form and detail, and is a refreshing contrast to some of the structures which surround it, while internally it is one of the pleasantest, most convenient combinations of library and reading-room it has ever been our pleasure to visit.

Space would forbid more than a mention of a few of the other successful buildings of Buffalo. There is an excellent structure just completed for the German Young Men's Association on Main Street, by Mr. Richard Waite, of Buffalo; a few good church spires; and in the suburbs a Crematorium, by Green & Wicks, which has been illustrated in some of the architectural papers; also, a large asylum erected from the designs of Mr. H. H. Richardson; but the most interesting, if not the best development of the local architecture, is found in the private dwellings. The people of Buffalo have always taken a pride in their homes, if we may judge by appearances, for even the older houses, erected at a period when architecture was hardly good building, are, as a rule, pleasant, comfortable, and quite free from the questionable taste which marks the commercial architecture of the city.

The Buffalo architects have adopted one usage which is not entirely unknown about Boston, though there seems to be a feeling here that it is not practicable. Every one knows how troublesome it is to satisfactorily arrange the corner-boards of a clapboarded house. A regular pilaster finish, such as looks so well with a colonial design is not always desirable or possible, and an ordinary corner-board is apt to unpleasantly mark the angles of the house just where the architect would wish to keep them as unobtrusive as possible. In much of the more recent Buffalo work this difficulty is obviated by simply omitting the corner-boards entirely. The corner is flashed with zinc against the boarding and the clapboards are run out to the edge and mitered, or cross-lapped like shingles. In either case, the corner is perfectly tight against the weather. There is a house on North Street, just beyond Delaware Avenue, which well illustrates this usage, and is besides so successful in its color that it is worth while to notice it a little in detail. The lower story is in a rather dark red brick. The second story is clapboarded and portions of the gables are shingled, both surfaces being stained a rich, warm brown. The upper portion of the front gable is filled with rough plaster, stuck over with bits of opaque glass, and left a light gray tone. The roof is covered with blue slate. The outside finish is painted a dull Venetian red in the lower story, the architraves, etc., above being a very dark green, the sashes red, and the inside blinds white. The general effect is charming, just enough brightness about the windows to relieve the general sober colors, and with only the difference in texture between clapboards and shingles to mark the two upper stories.

Dark tones for house-painting seem to be the rule in Buffalo, and the white and yellow combination so dear to the colonial builders would stare itself out of countenance by contrast with its sober neighbors. Most of the houses along North Street, Linwood and Delaware Avenues, when not built of masonry, are stained and painted to a depth of tone which would be overpowering were it not that all the lots are quite wide, so that the houses stand entirely detached, with plenty of air and sunshine all about them, so that even without the added abundance of tone in the shape of foliage, the dark colors would hardly seem misplaced. Two examples will illustrate the scheme of color which seems most in favor. No. 390 Linwood Avenue is a large, hospitable-looking house, built of common brick in the lower story, with no architectural features except a few round arches. The walls above are shingled and stained a strong Van Dyck brown, with a little rough-cast work in the gable. The roof is stained a clear Indian red. Opposite this, No. 405 is much the same description of house — pressed-brick lower story, shingled walls and roof of a strong umber tone, a wide bay below, and a single, broad, overhanging gable. Both these houses are types, and are very good in mass, quiet and satisfactory in effect, and in thorough good taste. All the new houses are not equally good. The bad is mingled with the good quite as effectually in Buffalo as anywhere else, but on the whole, though the business blocks are so hopelessly commonplace, the balance is more than made up by the average excellence of the domestic work, and the Buffalo people may well feel a pride in their beautiful city and in the new work their architects are producing.

Decennial Index of Illustrations. — We have in course of preparation a classified index of the illustrations published in the *American Architect* from 1876 to 1885 inclusive. We find that in very many cases the *cost* of the building has not been stated, and we therefore, ask our contributors to furnish us the approximate cost of such buildings of their designing as have been published during the above-named years.

ILLUSTRATIONS

[*Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.*]

HOUSE OF J. G. MITCHELL, ESQ., BROOKLINE, MASS. MESSRS. CABOT & CHANDLER, ARCHITECTS, BOSTON, MASS.

[Gelatine Print, issued only with the Imperial Edition.]

HOUSE OF G. H. DUNBAR, ESQ., BUFFALO, N. Y. MR. E. A. KENT, ARCHITECT, BUFFALO, N. Y.

BROWN-STONE in snake joint; shingle second story; oak finish and floors; Durham drainage; entire stairway carved; cost $14,000.

NATIONAL MONUMENTS, II. — THE DOM PEDRO COLUMN, LISBON, PORTUGAL. M. DAVIOUD, ARCHITECT; THE CARLISLE COLUMN, CARLISLE, ENGLAND. PROFESSOR COCKERELL, ARCHITECT; THE VENDOME COLUMN, PARIS. MM. LEPERE AND GONDOIN, ARCHITECTS; COLUMN OF JULY, PARIS. MM. ALAVOINE AND L. J. DUC, ARCHITECTS; COLUMN OF THE PLACE DU CHATELET, PARIS. M. BRASLE, ARCHITECT; THE CONGRESS COLUMN, BRUSSELS, BELGIUM. MM. GEERS, SCULPTORS; THE COLUMN FORMERLY AT BOULOGNE, FRANCE. M. DE LA BARRE, ARCHITECT; THE WASHINGTON MONUMENT, BALTIMORE, MD. MR. ROBERT MILLS, ARCHITECT.

SKETCHES AT BUFFALO, N. Y. BY MR. C. H. BLACKALL, ARCHITECT, BOSTON, MASS.

THE PALACIO POLENTINOS, AVILA, SPAIN.

EXHIBITION OF BUILDING MATERIALS AT THE BRUSSELS BOURSE.



STATUE
CHURCH OF ST NICOLAS-DE-PORT

THE Belgian Society of Engineers and Manufacturers, which sprang out of the Railway Jubilee of 1885, has not been idle during the first two years of its existence. Already has it held five special exhibitions, viz.: of M. De Lesseps's plans and models of the Suez and Panama canals; of metallic permanent way for railways; means of illumination, from the rush-light to the electric-lamp; India rubber and its applications; and telephonic apparatus. The sixth exhibition, which is now open to the public on payment of a small admission fee, is devoted to all constructive materials, except the metals; besides the usual run of bricks and tiles, natural and artificial stone, lime, cement and colors, there are a few exhibits of exceptional interest that merit a word or two of special notice.

Very interesting objects are the millstone and *pierre à concasser* or stone for crushing, hewn by the Romans out of the Landenian (Silurian) sandstone, a formation extending over a large portion of Belgium, the stratum of sandstone which it contains varying from 0.20 metres (eight inches) to five metres (sixteen feet.) The Romans made mill-stones of this rock, as proved by the specimen exhibited, which was found near Louvain; but, although the stone has been worked subsequently for various purposes, it does not appear to serve now for any other use than paving-setts. The stone for crushing, carefully fashioned with ears for holding it out of the same rock, was found in the quaternary clay near Tirlemont at a depth of six metres.

The principal building stone of Belgium is the "*pierre bleu*" or "*petit granit*" which occurs in the southern portion of the kingdom. It is not a granite, but a limestone of very fine texture, easily wrought, and capable of taking a high polish, when it appears almost black. Various objects exhibited, such as finials, show that this stone lends itself readily to artistic decorations. When used for quoins, window-sills and enrichments in the old Flemish houses, this stone forms a pleasing contrast to the dark, dull red bricks of the country; and for such a purpose it is most suitable. But it is, unfortunately, much used also for the flags and curbings of footways, and for this purpose it is most unsuitable. Owing to its soft nature, this stone wears away, often unevenly, leaving large hollows which hold the water, and wearing quite smooth, so as to be very slippery in wet weather. There are some curves in the tortuous Montagne de la Cour, the principal street of Brussels, connecting the upper and lower towns, where the side of the curb has been half worn away by the carriage-wheels, as proved by the iron clamps connecting two lengths, which originally placed in the middle, are now on the outside.

A far better footway, for dryness, appearance and the prevention of slipping, is formed by what are called "*platines*" or the finer variety of porphyry setts, cubes of three or four inches square, laid either parallel with the curb or diagonally, when they present a very neat appearance, the larger and rougher setts forming capital roadways. The principal porphyry quarry in Belgium is that of Quenast, which is one hundred hectares or three hundred and seventy acres in extent, and produces one hundred thousand paving-setts a day, which are exported to many European countries. An excursion to this celebrated quarry has been arranged by the Belgian Society of Engineers in connection with the present exhibition.

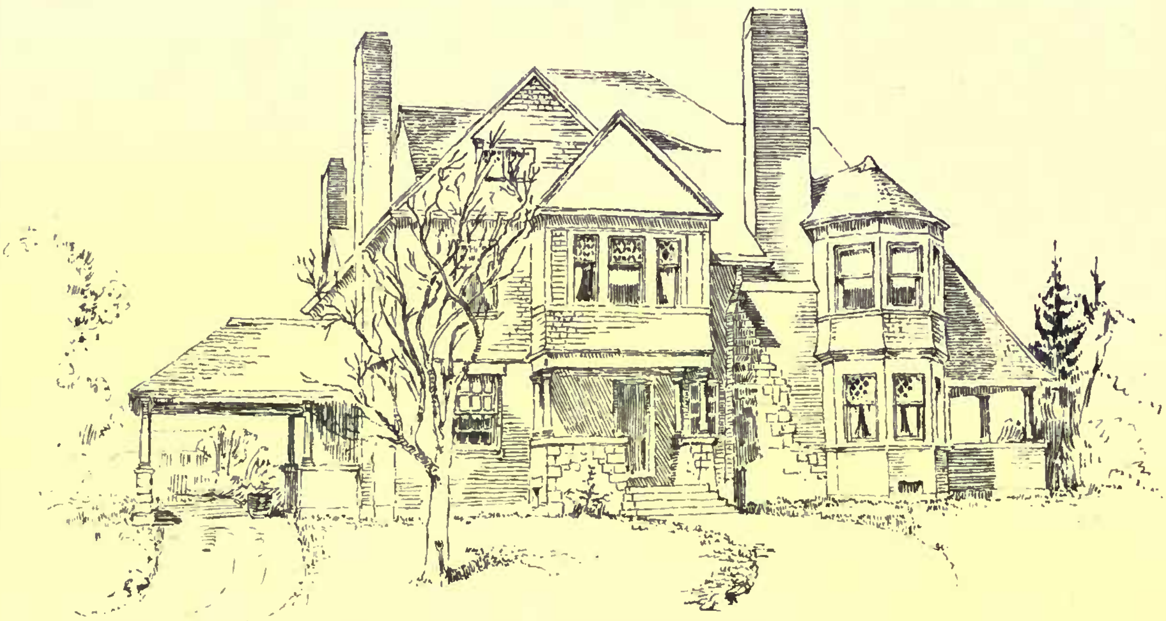
The beautiful Belgian marbles are also largely exported, and are well represented at the exhibition. They may be classed generally under two varieties, the red and the black, among the former of which the *Rouge Royale* is the best known. The black variety with white streaks of greater or less prominence, deserves, however, to be more used. Among the latter, the *Grand Antique Belge*, the *Sainte Anne*, and the *Couquilié* or Shelly, merit special recommendation. Here it may be mentioned that the Belgian *cheminée* or mantel-piece is a much more elaborate affair than the British, being returned at the sides of the chimney-breast, while the uprights are often set diagonally, and the slab is often gracefully curved. Some of the specimens of the leading varieties of Belgian marbles, prepared like subjects for the microscope, to demonstrate the origin of the Devonian and Carboniferous limestones, have been sent by the director of the Brussels Natural History Museum. They are ground down to one-tenth of a millimetre or 0.0039", being stuck down between two glass plates, and are mounted in vertical frames, so that their structure may be seen, and also examined by a magnifying glass, on looking through them against the light.

Some specimens of artificial marble are contributed by Bruno & Co. so true to nature that they can only be detected by the absence of those fine clay veins which somewhat detract from the appearance of real marble, and also lead in time to its disintegration. This substance is produced at from four francs to eight francs — that is to say less than one to two dollars — per square metre, while some excellent marble mosaic is laid by Souffler-Leblond for twelve to twenty-five francs — five dollars — per square metre.

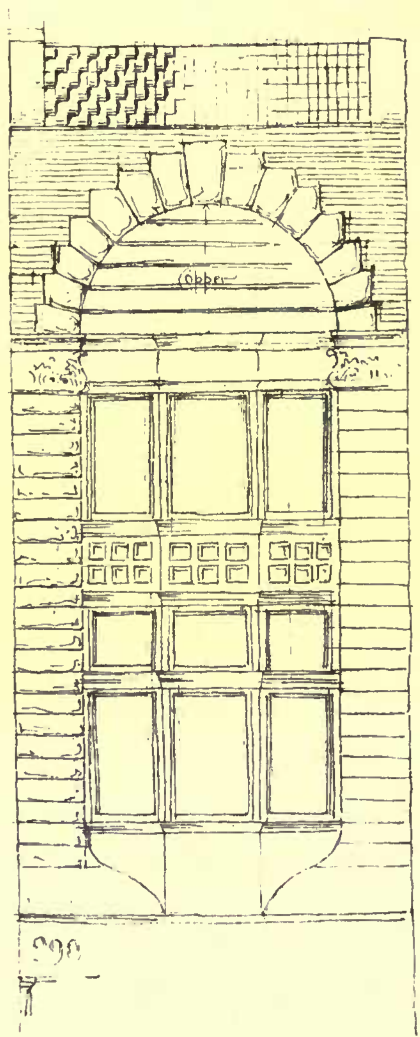
M. Dassonville de Saint Hubert makes improved Portland cement, under license from R. Bosse and F. Wolters, into the composition of which blast-furnace slag largely enters. It is ground so fine that a sieve of five thousand meshes to the square centimetre, 0.155 inch, will only intercept ten per cent, and one of one hundred and eighty meshes one per cent. In a series of tests carried out by German Government engineers, this cement mixed with three parts of sand showed a resistance to tensile strain of 244.6 pounds per square inch after seven days, and of three hundred and thirty pounds after twenty-eight days, setting. Picha Frères, of Ghent, make various articles, such as the basins of fountains, tanks and troughs, of cement with an iron wire foundation inside to increase the strength. Renette & Co., of Louvain, sink wells in loose sandy soil by means of their concrete rings, which fit one into the other with a socket-joint, the interior being plain and smooth. The surface of the ground is first levelled, and the bottom ring, which has a bluntly bevelled and somewhat splayed-out edge, is laid upon it. The earth inside is then excavated, and the ring sinks through its own weight. When its top is nearly flush with the surface, another ring is added, the joint being cemented, and the excavation is continued, and so on until water is reached. In this way, accidents due to the earth's falling-in are avoided, and contaminated surface-water is intercepted.

Several makers show bricks, hollowed out, some longitudinally and others transversely, in accordance with their external form, but always having feathers left in the middle for strength. Léon Champagne & Co. make what they call *voussoirs*, or hollow bricks approaching the wedge shape, for turning flat arches over the space between rolled-iron joists, and thus making a fireproof floor. The Société Anonyme des Deux Mèthes accomplishes the same object by a similer use of hourdis, or long and wide slabs, made of clay like the hollow bricks. Again, L. Vaillant, of Brussells, makes somewhat similar slabs of plaster-of-Paris, for the some purpose, the rounded edge of one fitted into the hollow edge of the other. Similar but solid slabs of plaster are made by the Société Anonyme des Fours de Laeken for forming light fire-proof party-walls, with the object of dividing a large room, for instance, when there is no wall below.

The two firms of Dammon & Cassard and Tasson & Washer have long been favorably known for their parquet flooring, and send men to lay them in the various countries in Europe. These firms are now united under the style of Dammon et Washer, who exhibit some inlaid panelling, in which the joint between the several woods is represented by a mere line, so excellent is the workmanship. A specimen



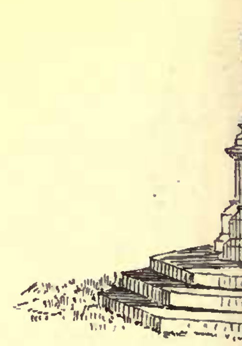
by Green & Wicks -



Building on Main St.

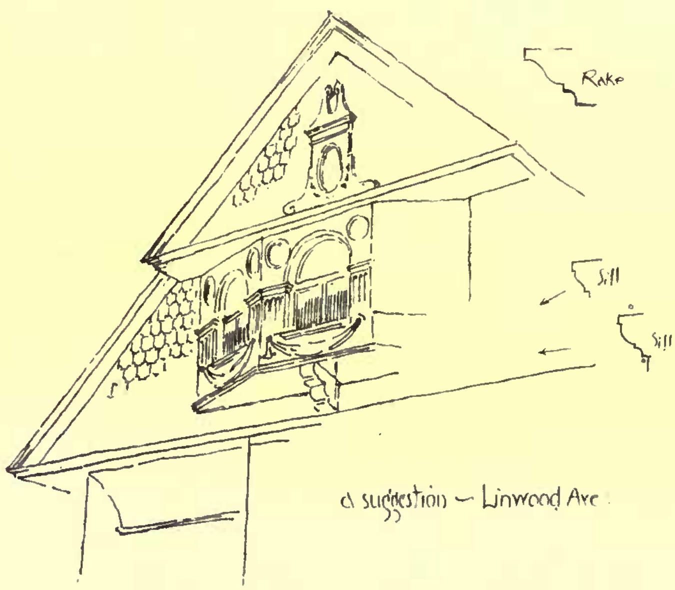
from memory.

Soldiers' Monument in Public Square.



A House by Green & Wicks



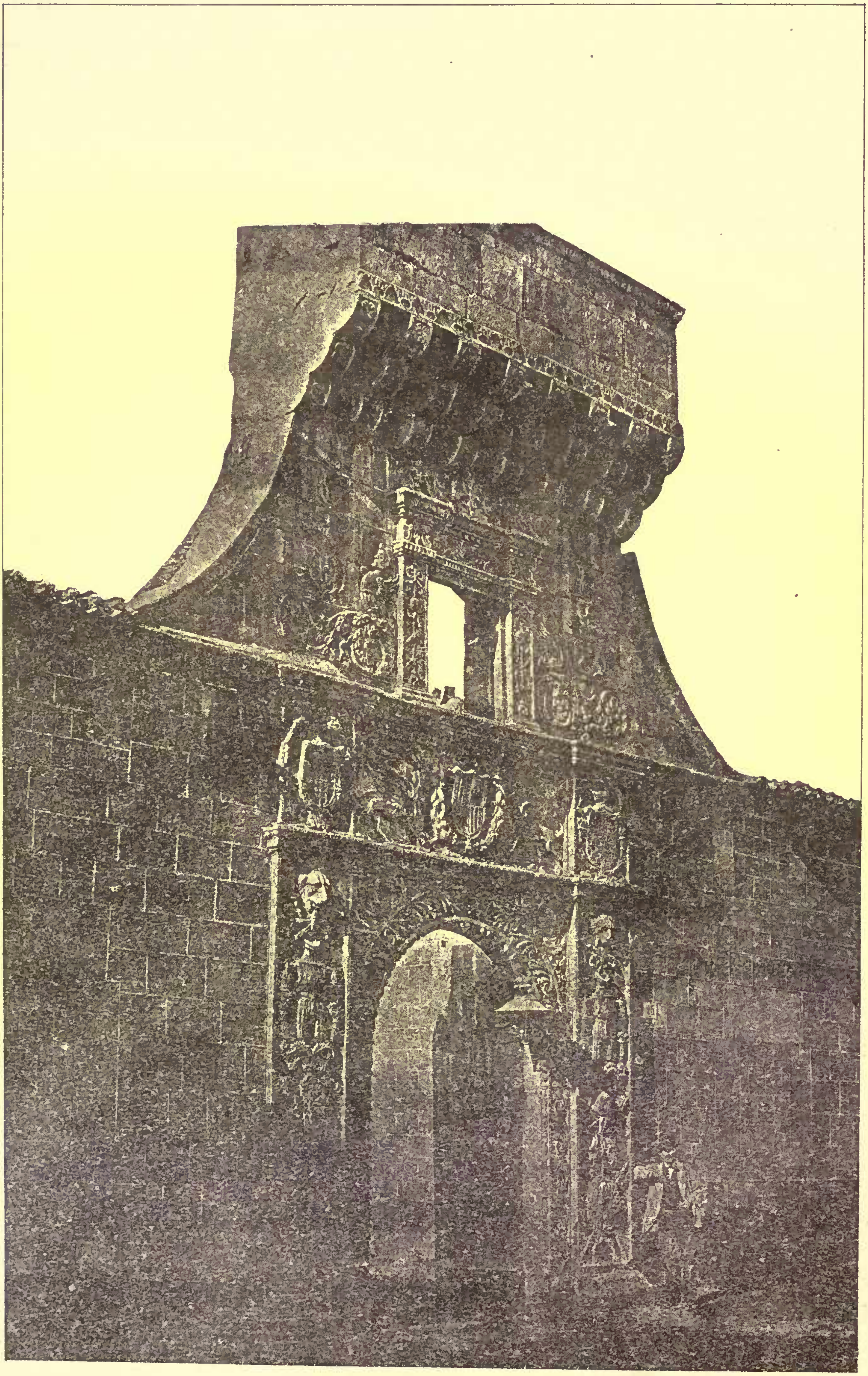


a suggestion — Linwood Ave



~Sketches from Buffalo·N·Y~

by C·H·Blackall·

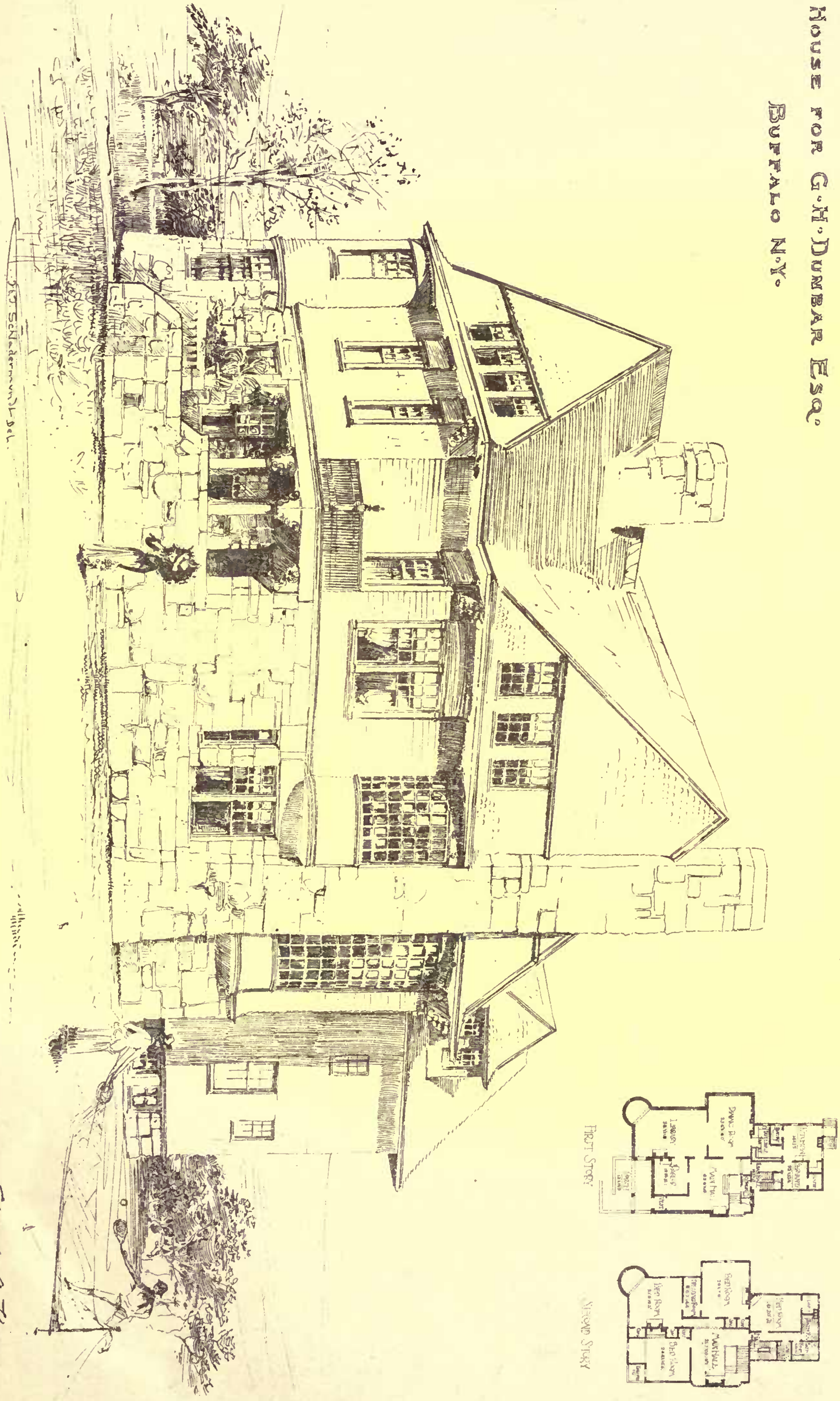


Heliotype Printing Co Boston

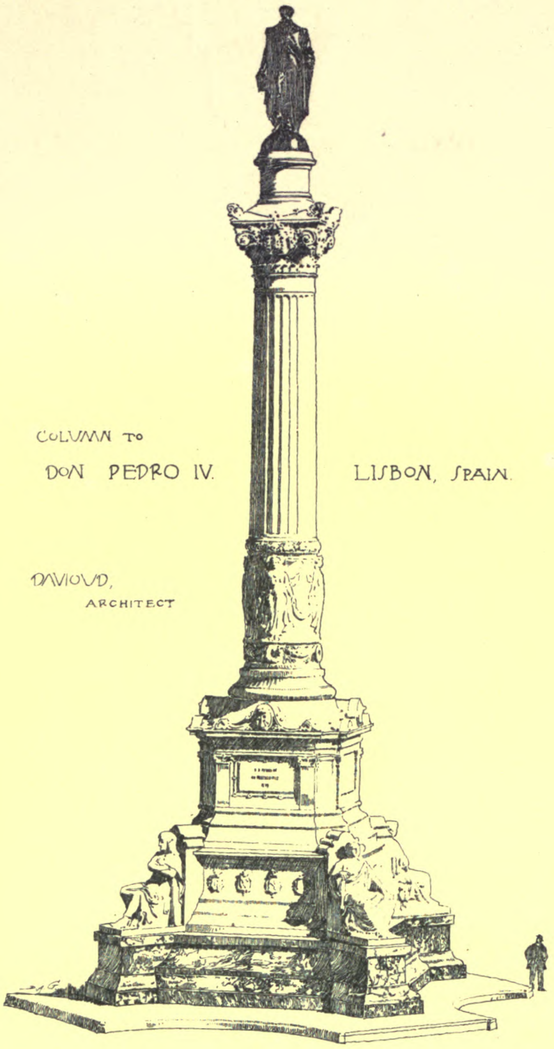
Palacio Polentinos, Avila

AMERICAN ARCHITECT AND BUILDING NEWS, JULY 16 1887 No. 603

HOUSE FOR G. H. DUNBAR ESQ.
BUFFALO N.Y.

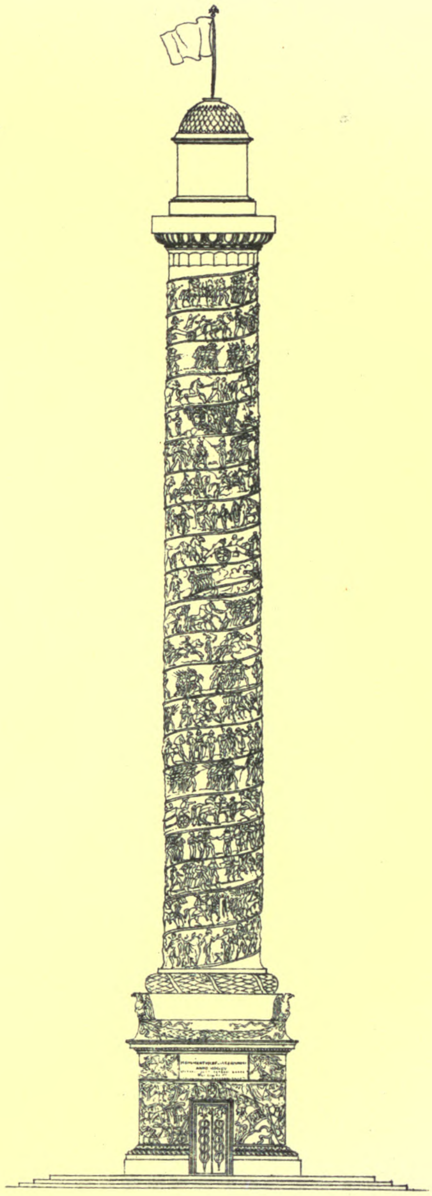


Heliotype Printing Co. Boston



COLUMN TO DON PEDRO IV. LISBON, SPAIN.

DAVIOUD, ARCHITECT



VENDOME COLUMN, PARIS.

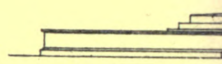
HEIGHT 133 FT. DIAM. 12 FT.

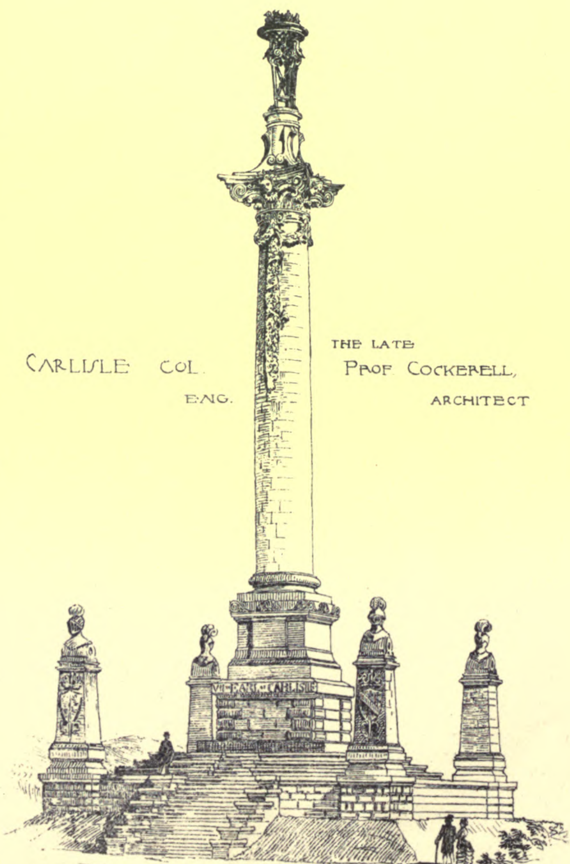
ORIGINALLY SURMOUNTED BY A STATUE OF NAPOLEON.

COLUMN, BOULOGNE

M. DE LA BARRE, ARCHITECT

HOUDON, SCULPTOR





CARLISLE COL. ENG.

THE LATE PROF COCKERELL, ARCHITECT

CONGRESS COL

W. AND J. GEEFS, SCULPTORS



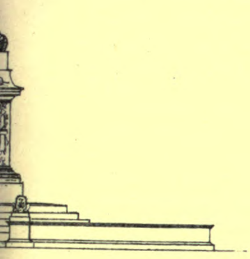
NATIONAL

ICKNOR & Co.

FRANCE

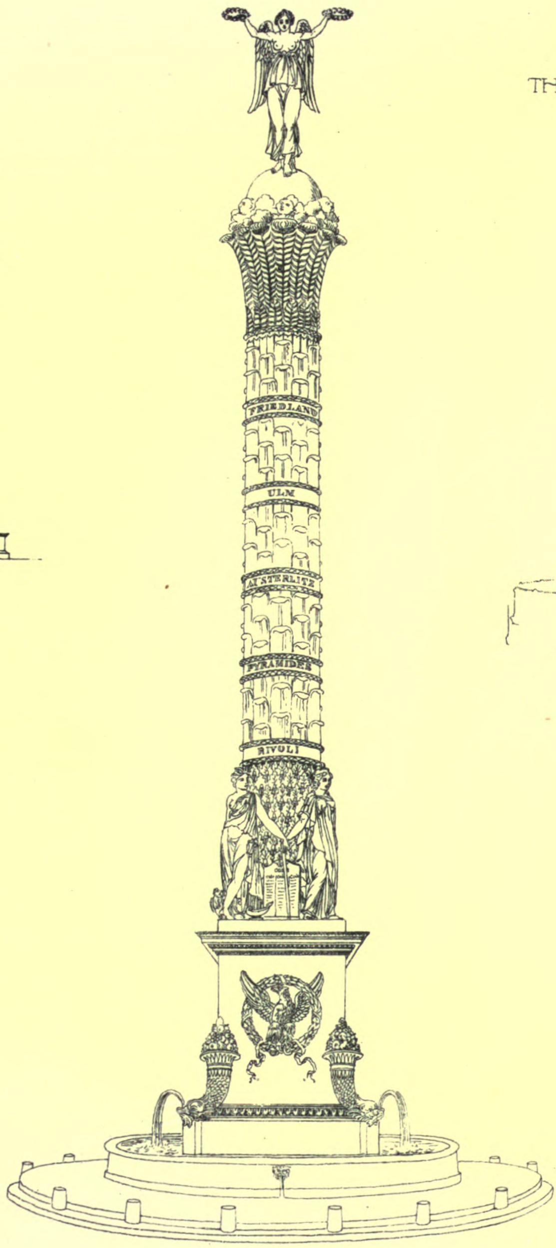
DESTROYED 1815

HEIGHT 132 FT.
DIAM. 12 FT.



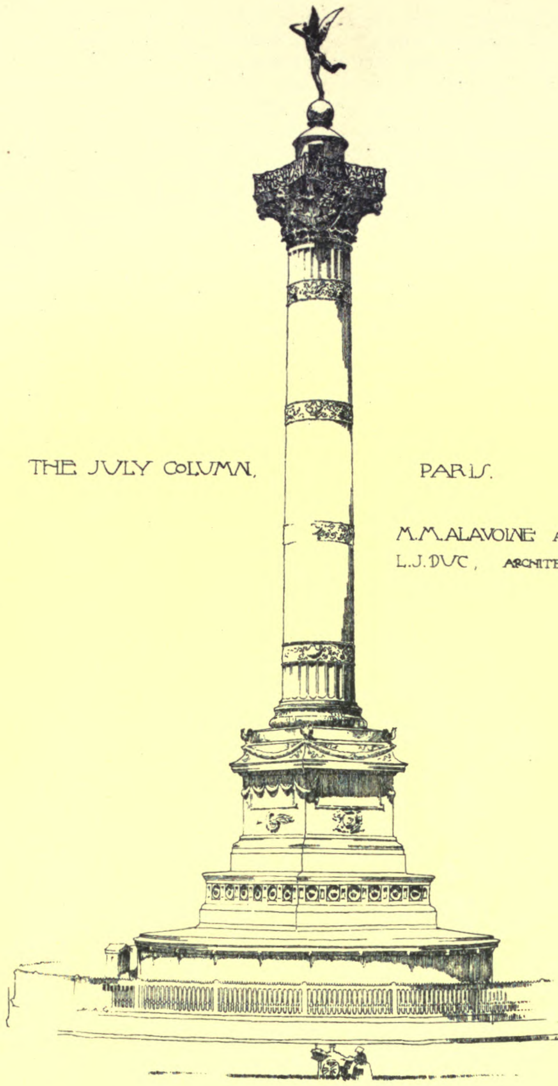
BRUSSELS.





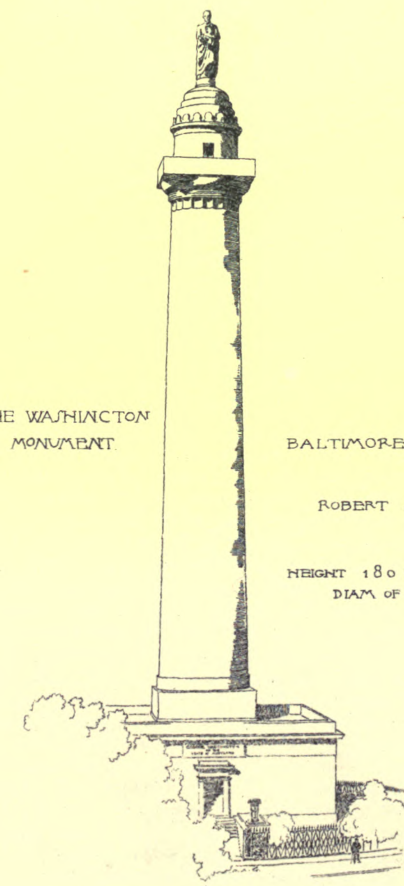
FOUNTAIN PLACE DU CHATELET, PARIS.

M. BRASLE, ARCHITECT.



THE JULY COLUMN, PARIS.

M. M. ALAVOINE AND L. J. DUC, ARCHITECTS.



THE WASHINGTON MONUMENT

BALTIMORE, MD.

ROBERT MILLS, ARCHITECT.

HEIGHT 180 FT.
DIAM. OF COL. 20 FT.

MONUMENTS

Heliotype Printing Co. Boston.

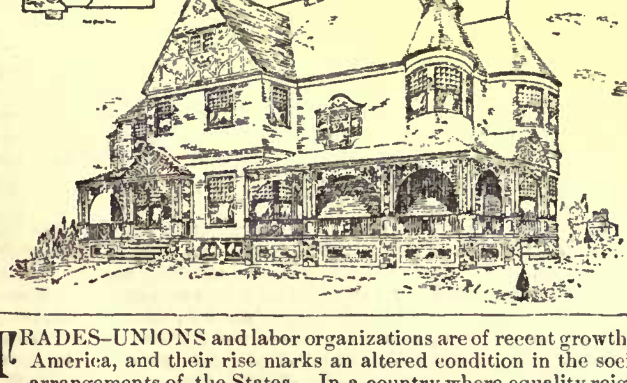
is exhibited showing the construction of a capital floor that is laid down at the Brussels Hôtel de Ville, the Palais de Justice and the newly completed Palais de la Nation. On slight flat arches, or directly on the ground, are laid tiles with conical holes in the centre of each. Over these is spread a layer of hot asphalt or bitumen, which enters the holes and also the internal dovetails made half in each long-ways edge of the pieces of parquet flooring, laid while the asphalt is still hot, so that on cooling it forms a key between the tiles and the parquet floor, making all solid together. Such a floor is noiseless, sound-proof, damp-proof and practically fire-proof. A stronger and more fireproof modification of the above is made by turning shallow arches in concrete between light rolled joists, leaving internal dovetails in the upper surface of the concrete. Liquid asphalt is poured over this; and while it is still hot, parquet pieces with dovetails as above described are bedded therein.

It must be confessed that so-called asphalted or bitumenized felts for roofs have not hitherto given very good results. The layer of gas-tar or what-not is soon melted in a hot sun; and the unprotected felt then becomes disintegrated very speedily. M. Em. Pierret, of Vilvorde, claims to have changed all that with his inalterable roofing cloth, which he sells for a franc to the square metre, offering to lay it in Belgium for less than half the amount in addition. A coarse flaken tissue is impregnated and coated with a substance consisting chiefly of an artificial bitumen extracted from petroleum to which are added small quantities of natural bitumen, chalk and resin. One side is sanded to prevent adhesion when the cloth is rolled up; and the sanded side is placed uppermost. The bitumenized cloth is laid in continuous length across the lower side of a sloping roof, and then another length above it with a lap of about three inches, and so on over the whole surface the uppermost length being bent over the two sides to form the ridge. The cloth is held down directly to the rafters, which may be spaced twelve or fifteen inches apart, by washers of the same material secured by zinc nails. The maker asserts that his roofing cloth is unaffected by heat, and that it forms the lightest roof in the market.

Petroleum is also pressed into the service of the building trade by Rave, Annez & Co., of Mechlin — the old city whose lace is a thing of the past, being superseded by oak carving in imitation of the antique. These makers have patented a process for preparing, from petroleum, a drying oil for painting claiming that, while being fifty per cent cheaper than linseed oil and dryers, it is not unwholesome in manufacture or application, and permits of several coats being laid in the same day, so that work in a hurry may be pushed on apace. It appears that this mineral oil will unite chemically with all but two colors (for which substitutes are found), when in a finely divided state without the necessity of grinding, as usual; and this is the only drying oil which may be easily applied to cement, so as actually to combine with it. The oil also serves as a varnish at one-fourth the cost, and may be laid on tarred or bitumenized surfaces, without their showing through.

The exhibition is proving highly successful and attractive; and lectures connected more or less directly with the exhibits are given weekly. Thus, M. Wellens, Inspector General of Ponts et Chaussées, and President of the Belgian Society of Engineers, has lectured on the materials employed in the construction of the Brussels Palais de Justice; M. Rutot, Conservator of the Natural History Museum, on the origin and mode of formation of the sedimentary rocks; and M. de Schryver, Ingénieur Principal des Ponts et Chaussées, on Portland-cement mortar and concrete. J. W. P.

TRADES-UNIONS IN AMERICA.



TRADES-UNIONS and labor organizations are of recent growth in America, and their rise marks an altered condition in the social arrangements of the States. In a country where equality reigns sufficiently to render the intercourse of master and man perfectly free from restraint, where capital is fairly diffused, and where land, the great source of wealth, stands ready for all who can accumulate the small sum necessary to build a rude home, and maintain it until the first harvest, there is little incentive for men to form class combinations. Hope bids them cast their eyes forward to a better and more independent condition, where the close of each week will see them not only provided with subsistence for the next, but with something added to their home or personal surroundings which shall be a pleasure or a convenience for the remainder of their lives. The troubles of the present are thus borne with equanimity, since they receive only partial attention, and form but a stepping-stone in the path to the more prosperous condition of the future. If real grievances exist, there is no obstacle to laying them before the employer, for he is always to be met with, and a discussion of the situation will find a remedy or demonstrate the necessity of bearing the infliction, whatever it may be, until one of the frequent changes which occur so rapidly in new countries, brings relief. When the best men in a workshop are ever breaking out of the ranks, and abandoning their class, and many of the remainder imagine that some day the same chance will come to them, there is no material upon which to found an organization framed to defend the laborer from the capitalist, and to secure to the former a larger share of profits than he would otherwise get. It is only when workmen realize that there is practically no hope for them to exchange their calling for a better, and when they lose acquaintance with their employer, that they bind themselves together in a union, and endure all the discipline and self-sacrifice it involves. In England unionism can be traced, in some form or other, back to the time of Edward VI., and represents the efforts made by the craftsmen to free themselves from a condition which was little better than the villeinage of the feudal age; it was created by repressive legislation which gave the workman his choice between an arbitrary wage settled by the magistrate, the branding iron, and the gibbet, and it has endured in spite of the law, the pulpit, and the press, until it has become one of the most powerful industrial forces of the time. In America the potent factor to weld labor into a compact body has been the accumulation of wealth in the hands of individuals and corporations. The small manufacturer is rapidly disappearing; trade rivals, armed with all the advantages of unlimited credit, struggle with each other for the monopoly of the market, and in their conflict they heedlessly stamp him out of existence. And with him goes the kindly feeling which had grown out of the personal contact of employer and employed, and also the principal ladder on which the workman hoped to rise to competence. The land, too, has ceased to offer the attractions it once did. Every year it recedes farther westward, and even there the capitalist grows omnipotent; cattle are raised by thousands on ranches covering hundreds of square miles, and owned by men who live at ease in New York and London; huge sections of country are in the hands of the railway companies, who retail them at comparatively high prices; and wheat has fallen to a figure which scarcely leaves a profit to the man whose land extends as far as the eye can reach, and who commands the best appliances of the day. On all sides the horizon closes in on the poor man; it is true that he has greater comfort than ever before in the world's history; he is better fed, better clothed and better lodged; he has more leisure, and can fill his spare hours with all the resources of literature, while he can enjoy no inconsiderable share of the beauties of nature and art, if he have the appreciation for them. But the doors of hope are closed against him.

Speaking generally, the workmen can never escape from his daily toil and cannot rise in the social scale. The aggregation of capital which characterizes the present age, has doubled his physical comfort and his capacity for intellectual enjoyment, but it has robbed him of the flattering unction with which he once nourished his soul that he could enter the class above him. Who shall appraise the good and the harm it has done him, and strike a balance between the two? The ingenuity of the poet could find no characteristic of Inferno to write over its portals more descriptive than its hopelessness, and certain it is that the working classes have a far keener sense of the loss, sentimental though it may be, that capital has brought them, than they have of the gains they reap from it. In America they have abandoned the position of careless confidence they formerly held, and by welding themselves into unions now meet the employers in pitched fight and extort their full share of all present profits.

Statistics regarding labor organizations are not available for the whole of the United States, but we may take Illinois as a representative State, and trace the rise and development of trade-unionism there, as a type of the whole country. The most notable feature in labor organizations is the Order of the Knights of Labor, whose fame has spread even to this country. The Order is not strictly a trade-union, as it is not confined to members of specific callings, but embraces persons of all occupations, with the exception of bankers, lawyers, gamblers, and liquor dealers, who are excluded. Among the ranks are found men of all trades — merchants, farmers, teachers, officials, editors, and professional men — but the bulk of the members are of the industrial classes — mechanics, artisans, clerks, miners, and laborers. Out of 32,857 Knights of Labor in Illinois, 70 per cent are skilled workmen, 26 unskilled, and 4 per cent neither. The object of the Order is not to champion any particular section of the industrial army, but to gather them all under the banner of a modern knight-errantry, which shall charge itself with the welfare of all classes, be they skilled or unskilled, male or female, black or white. The leading features of the knights' programme are the modification of all laws which are prejudicial to labor, and the substitution of arbitration for strikes. This latter point will come as a surprise to most, for it is in connection with strikes that the Order has been oftenest heard of. It goes forth full of persuasion, but when capital turns a deaf ear to its conjuring, the energy of youth hurries it on, and it strikes both hard and widely, having neither the experience nor the caution of the older unions.

The organization of the Knights of Labor is conceived on a broad basis, to suit its aspirations, which are national in their width. The primal formation is the local assembly. As these multiply they contribute representatives to district assemblies and State assemblies, and these in turn combine to form the General Assembly, the ultimate governing authority. The Order is not confined to towns, the homes of unionism, but has spread into villages, where it has made many converts, adding to its strength until it equals all other labor organizations united. The very success of the Order renders it difficult to give an accurate estimate of its numbers, for they are increasing daily, and the figures at our command, which are published by the Bureau of Labor, only extend up to last July. At that time there were 204 local assemblies of Knights of Labor in Illinois, distributed throughout 51 of the 102 counties of the State. The original membership of all these assemblies was 6,899, while the number a year ago was 34,974. It is estimated that 300 assemblies were in existence at the close of 1886, and that they comprised 52,461 members. To obtain an idea of the power of the Order, we must compare its numbers with those of the entire industrial population. This cannot be done exactly; but still there are a good many figures available which will serve as a rough basis of comparison. In the first place the trades-unions of Illinois comprise 61,904 members, about 17 per cent of whom are also Knights of Labor; then the last returns for the coal-fields show a total engaged in mining of 25,846; the men employed on the railroads were found by the Bureau of Labor statistics to amount to 43,651 in 1882; and in 1880 the census tables showed 120,558 males employed in the manufactures of Illinois. Omitting the unionists, who, of course, are counted in the census, we find that in the three great divisions of manufacturing, mining, and industry, there is an aggregate which must be much understated at 190,000, of whom rather less than a fourth are Knights of Labor.

The first assembly of the Order was organized in 1877, and up to the end of 1881 its progress was so slow that there were only nine assemblies. Then the increase became rapid, there being 60 assemblies in 1884, 110 in 1885, and 204 in July, 1886. Of those assemblies, 55 are formed of members of specific occupations, while the remainder comprise a variety of occupations. It is curious to note the distribution of nationality of the members, as shown by the annexed table:

Americans	15,241
Germans	6,199
Irish	4,919
Scandinavian	1,955
English	2,287
Poles	943
Bohemian	1,657
Scotch	175
Italian	103
Welsh	65
Unreported	1,430
	34,974

The native-born Americans do not constitute one-half of the whole, although they enter this organization more freely than the unions, on account of its requiring no standard of craftsmanship, and from its political aspirations. The keen youth of the country has read the signs of the times so well that he selects occupations in which a living is made by the wits in preference to handicraft, for the former offer a far more hopeful prospect to the man anxious to get on than the latter, as they provide chances which can be filled by shrewdness and industry, while the few openings in manufactures demand much accumulated technical knowledge and a scientific education. We therefore find that four-fifths of the mechanics and artisans of Illinois are of foreign antecedents and habits.

We have given so much space to the Order of the Knights of Labor that we shall have to curtail our account of the trades-unions. This, however, is of less consequence, as they are to a great extent copies of similar organizations in this country. Few of them are old, while a great number are quite recent, the idea of combination having received a great stimulus from the success of the Knights of Labor and from the eight hours' movement.

Of the whole number, 226 organizations have been established during the last five-and-a-half years, and less than one-fifth are of earlier origin. But within this period much the greater progress has been developed during the year-and-a-half preceding last July. In 1885 and the first six months of 1886, 140 out of 226 organizations came into existence, and more than half of these in the latter period. The older unions are those of printers, iron-moulders, tailors, carpenters, locomotive-drivers, stone-cutters, and cigar-makers, all of whom were established in the decade, 1860–70. Between 1870 and 1880 the locomotive-firemen, glass-blowers, plasterers, furniture-workers, hod-carriers, seamen, bricklayers, metal-workers, and others appeared; while in the latter period since 1880 the spirit of organization has not only spread among the classes named, but has pervaded all classes in which there was any community of interests upon which to unite.

In the State of Illinois 483 labor organizations have been tabulated, and 125 of these report 212 strikes as having taken place within their experience, involving 50,522 men. Of those contests 86 were carried to a successful issue, 31 were compromised upon some basis of mutual concession, 63 failed, and 28 were unsettled at the time of the report. On the whole, the American unions appear more ready to fight than those at home, not having acquired the experience which comes with age, and probably not receiving the consideration extended to them here. Manufacturers are very apt to resent the interference of delegates on their first appearance, and to precipitate a conflict, hoping to crush the union before it has become firmly established. Of all the races which people the States, the Germans appear to take most naturally to trades-unions. Their natural clannishness and the habits of forming clubs, n odoubt, contributes to this, while their home training prepares them for the discipline and surveillance of the union. The Irish are next in number to the Germans, and nearly equal the Americans in the various trades-unions. They prevail in the railroad business, both on the road and in the yards and freight-houses, but more particularly in the stationary service. They also constitute the majority of the bricklayers, stone-masons and plasterers, but strange to say that as hod-carriers they are outnumbered by the Germans, though only second to them. The fact of Germans ranking below the Irish in the industrial scale is one that would not be received, if it were not vouched for by the official publication of the State of Illinois. — *Engineering.*

BOOKS AND PAPERS.

"*THE ESSENTIALS OF PERSPECTIVE,*"[1] by Mr. L. W. Miller, is an informal treatise for the use of the artist (painter we presume), or the draughtsman. It is ingeniously illustrated by examples which appeal to general experience in nature and by cases of actual practice, or malpractice — more often the last — in the works of painters. Its merit is in the directness and freshness of its presentation of the subject, especially its boldness in bringing in from the start, and as a matter of course, certain ideas which are usually carefully shunned in rudimentary treatises — the vanishing-lines of planes, and the determination of vanishing-points by secondary horizons. These are conceptions which are essential to any real understanding of perspective phenomena, but are kept out of sight in the ordinary text-books, and invested with unnecessary awe, through the same mistaken timidity which confines the ordinary pupil's study of geometry almost exclusively to plane geometry, and so defrauds him of the ideas which most give point and practical meaning to his study. If the working out of the book were as good as its idea, it would be a valuable substitute for the worthless treatises on perspective which abound.

Most of these treatises assume that the essence of perspective, and also its chief difficulties lie in its processes, and that if they can cut these down to a few rules-of-thumb, the true object of the study will be secured and its hardships evaded, without wasting the learner's time on general conceptions. On the contrary, the real difficulty, and also the real use and value are in the conceptions. The artist who has mastered them is better off without any process at all than he who has not, though with all the practical devices of the books at his disposal. Moreover, when he has mastered them it is an easy matter for him to simplify or multiply his processes according to the needs of his work. To acquire and order these conceptions is the chief labor of learner and teacher, and in this is commonly the chief failure of both. A recognition of this fact seems to have been Mr. Miller's motive. He gives considerable pains to making clear the first ideas of perspective conditions, and to clearing up misconceptions and nonconceptions which are common among painters as well as people who are not painters. But his scheme, which is a good one, is carried out with too little thought, and the workmanship of his book is careless, which, in books of this kind, is the common offence, and a grave one. If the author of such a book thinks he can make it more attractive by a free-and-easy style, he is at liberty to; but he is none the less bound to see that his ideas are well and clearly arranged, his thought exact, and his language precise, however free it may be. Some parts of this book have been well thought out, and many of the illustrations studied with a care and clearness that make them admirably effective. But the texture of it is loose; much of the discussion too summary to be clear, holes are left unstopped which the pupil may not see, but ought, and the affectation of carelessness in the style may easily persuade him, to his injury, that there is nothing in the subject after all that requires much care. The result is that some of the explanations can hardly be understood by one who does not know the subject; many things are referred to or assumed that are not explained, others are hinted at and not worked out, and here and there are downright blunders which, as the rest of the work shows, can only be the result of carelessness.

Thus, in describing parallel perspective Mr. Miller does not take the pains to show that it belongs to systems of lines at right angles, parallel and perpendicular to the picture; nor that most of the constructions of perspective, especially the "two-point" and "three-point" systems, which he specifies, are based on the right angle. In his haste to generalize he does not even make it clear to his learner that the centre is the vanishing-point of lines perpendicular to the picture. In many cases, to save the learner trouble, he contents himself with showing him a construction which gives a drawing consistent with itself, and therefore possible, but does not tell him how to determine an actual case, nor hint at any difference. The chapter on measuring, good in its scheme, does not make clear the essential difference between two methods — one applying to lines parallel

[1] "*The Essentials of Perspective,*" with illustrations drawn by the author. By L. W. Miller, principal of the School of Industrial Art of the Pennsylvania Museum, Philadelphia. New York: Charles Scribner's Sons, 1887.

to the picture, the others to those at an angle with it. The tyro will find it not easy to understand the chapters on shadows and reflections, or to get practicable methods from them, though he will get many good ideas of the phenomena. That on circles is loose and inadequate: it gives but one construction for the circle, and that might be simpler, for it requires the use af a plan; nor is his attention called to the important question, what becomes of the centre of the circle? or to the phenomena constantly occurring and constantly misrepresented in drawing of circles with a common axis, as on the surface of a cylinder. On the other hand, the chapter on curvilinear perspective is excellent, although we think that when he assumes to correct Ruskin, the author misrepresents Turner as much in one way as Ruskin does in another.

It is simple carelessness to make on page 9 a proposition which implies that all the lines oblique to the picture tend to one vanishing-point, and to say, on page 13, a flat surface for a level one. Page 75 tells us that "the shadow of a line on a surface to which it is parallel is always parallel to the line itself," which can only be said of straight lines and planes. The next page should say, "the shadow of any plane figure on a *plane*," etc. The statement on page 61 that the axis of the ellipse is at right angles to the axis of the wheel is true only in special cases; as a general statement it is untrue, as may be easily seen if we consider the case of a shafting pulley above the eye, and in a plane at right angles to the picture — a very ordinary case — where the axle of the wheel must be drawn parallel to the horizon-line, but the axis of the ellipse will incline toward the centre of the picture, or, as Mr. Miller properly calls it, the centre of vision.

On the whole, Mr. Miller's book is one of those which disappoint because they seem capable of being better than they are. It should be a stimulating book, for it is full of shrewd observation of natural phenomena, and remarks which should open the eyes of the novice to many things that clear eyes ought to see, but even painters often overlook. If it is understood, it ought to help the young painter materially in ordinary sketching; but its easy-going discussion is likely to encourage looseness of conception, and favor rather than forbid that contempt for the precision of the perspective which the author deprecates in his preface; while its processes are too inexact for the uses of exact draughtsmanship. We should advise artists or draughtsmen to read Mr. Miller's book, and then to learn the practice of perspective elsewhere.

NOTES AND CLIPPINGS

RENEWAL OF ROOF OF KING'S CROSS TERMINUS. — At a meeting of the Society of Engineers, held on the 6th of June at the Westminster Town Hall, a paper was read on the "Renewal of Roof over Departure Platform at King's Cross Terminus G. N. R.," by Mr. R. M. Bancroft.

A brief history and description was given of the construction of the old laminated timber roof, erected in 1851–2, according to the system introduced by Colonel Emy, a French military engineer. After pointing out the entire absence of ventilation in the old roof, and other causes of decay, the author describes the movable staging now being employed in the erection of the ribs of the new iron roof, the way in which it is moved from bay to bay as the work proceeds, and the means adopted for supporting the superstructure of staging so as to give a clear headway for locomotives, etc., and not to interfere with the departure passenger traffic. Reference was then made to a similar roof over the old G. N. R. passenger station at Bradford, its span, distance apart of main ribs, and weight per bay of 20 feet being given. The construction, hoisting, and fixing in place of the new wrought-iron ribs were described; and it was pointed out that they have to be made to fit the existing cast-iron spandrels and stanchions built into station-walls. The construction and fixing of the lattice and trussed purlins, and the gangways adopted to give greater facilities for workmen in repairing and cleaning the glass covering were also described. The author remarked on the absence of wind-bracing, and gave the reasons for not using it. He also described the method of glazing, both with putty for the roof generally, and with Helliwell's patent puttyless glazing at the Louvre. Diagrams were exhibited showing the general form of the roof and the movable staging, and the working drawings were also laid upon the table for reference, by the kind permission of Mr. Richard Johnson, M. Inst. C.E., Chief Engineer of the G. N. R., under whose instructions the work is being carried out.

MALTREATMENT OF THE "CORONATION CHAIR." — "We shall not know how much harm has been done to Westminster Abbey in preparing it for the royal thanksgiving service until the scaffolds have been removed," says the London *Athenæum*. "More care, it is believed, has been taken than on some previous occasions, but one wanton piece of mischief has certainly been committed. We shall scarcely be believed when we say that the Coronation Chair, perhaps to most Englishmen the most precious of all the precious relics in the Abbey, was handed over to some barbarian to be smartened up, and he has daubed it the orthodox Wardour-Street brown, and varnished it! Yet this is true. The chair, made 600 years ago to contain the stone which even then had a long story behind it, has suffered much from hard usage and from the hands of the mischievous. But not even in the perilous time when George IV was crowned was it attempted to take away the chair's age and make a new thing of it. Now, when we pride ourselves on knowing more about old art work than our fathers did, this has been done, and the throne of twenty-six monarchs has been vulgarized into the semblance of the hall chair of a Cockney Gothic villa."

RECENT EARTHQUAKE-SHOCKS IN JAPAN. — Professor Sekiya of the Japanese Imperial University who has been investigating the recent earthquake in Japan, recently read a paper before the Seismological Society giving the result of his observations. A narrow axis or band of country, running near to the coast and nearly parallel to its general trend, for about thirty miles, and reaching the shore at Yokohama, is described by Professor Sekiya as the seat or origin of violent emotion. As in some future heavy shocks in this country, the area of destructive effect was found to be limited to a small breadth on either side of the axis, so that places as little as two or three miles to the north or south of it experienced a well-marked diminution of seismic energy. The earthquake was preceded by the usual warning roar or rumbling, as of distant cannon, emanating apparently from the western part of the central band. Respecting the cause of the shock, Professor Sekiya believes it to have been a faulting or dislocation of strata in the earth's crust, a conclusion to which the geological and other physical features of at least the western half of the axial band lend considerable support. If he be correct, we have in this case a variation from the probable most common cause of Japanese earthquakes, which, according to Professor Milne, is underground explosion of steam. All along the central band, and more conspicuous in the western and hilly half than in the eastern, which is low tableland, the effects of the earthquake was strongly marked. In the former, fissures and landslips were very numerous. Professor Sekiya counted no fewer than 72 cracks in a distance of 7 miles, one of them being a foot wide and 500 feet long, and all of them running parallel to the axis of origin, which is also parallel to the main topographical features. In the same region, which abounds with villages and hamlets, the effects generally reached their greatest intensity. The sliding screens, covered with paper or of wood, which serve as doors, shutters, partitions, and windows in Japanese dwellings, were bent, broken, and shot out of their grooves. The paper covering or glazing of some partitions were rent and shivered in an extraordinary fashion, such as no other conceivable power could have brought about. Houses were cracked, mutilated, unroofed, twisted, tilted up, and more or less wrecked. Those of wood framing and heavily plastered suffered especially as to their walls. Yet, strange to say, though thousands of buildings were left tottering on the verge of demolition, apparently needing but a puff of wind to blow them over, only two were actually levelled to the ground. Several wells became turbid. In some of artesian character the water decreased permanently or failed altogether; in others it increased. One large river was so strongly agitated that the ferry-boat could not be taken across it for some time after the shock. The peasants say that they felt as if standing on waves of the sea. Many persons were thrown down; and one scared countryman vouches to having been obliged to crawl on all fours, owing to the impossibility of walking upright. To all these things were added the noise of the earthquake's ruthless work and the shrieks of affrighted women and children. At Yokohama the effects on buildings were corroborative of all that Professor Milne has, from time to time, told the world with regard to construction in earthquake countries. Houses in that town are of so many types that they afford a fair field for comparisons of results. Most happily, the intensity there was only one-third as great as in the hill region on the west. Had the maximum intensity reached Yokohama, it is more than likely that not a chimney would have been left standing, and that, in the foreign quarter at least, there would have been heavy ruin and loss of life. To sum up the conclusions deducible on the recent occasion and confirming all previous experience, it is now more than ever clear that the buildings of the composite construction common in this country, such as wood encased with brick or stone, are the earthquake's happiest playground. They are embodiments of the cardinal error of rigid attachment of parts of a building which have different periods of vibration — *i.e.*, which swing at different rates during earthquake shocks. Houses of weak construction — for example, of thin brickwork or wood and plaster — and houses built of bad materials or on faulty principles are also dangerous. But the composite houses are mere earthquake traps. Wooden structures, like the ordinary Japanese dwelling, are well enough — perhaps better than any as far as earthquakes alone are concerned, if thoroughly-well constructed. In Japan, however, fire is a more constant and even more dread enemy than the earthquake, and the latter often brings fire in its train as a result of the overthrowing of lamps. Sheet-iron houses, as used in Australia, would be strong, cheap, and effectual, but they have the drawbacks of ugliness, difficulty in providing against extremes of temperature and danger of typhoons. On the whole, it appears to be the conclusion of our seismologists that solid, heavy buildings of stone or brick, with their various parts well constructed, strengthened, tied and bonded on true principles of architecture, and with due knowledge of the strength of materials, are the best and safest for earthquake-ridden countries. The forces to be dealt with are forces altogether independent of gravity, and for the most part act in a horizontal direction, and architects and builders must apply the resources of their art accordingly.

MAYALL'S PHOTOGRAPHIC DISCOVERY. — The photographic as well as the daily press of England seems now to be much exercised over the "Mayall Process," although it claims nothing more than to be the means by which photographs may be rapidly colored by those who need not have great artistic ability.

An outline of his method may serve to give some idea of its merits. It will, probably, like many of its predecessors, meet with a wide appreciation in certain photographic circles, at least for a time.

The negatives, made on orthochromatic plates, are not retouched, In order to obtain the best results a solar camera print is made, toned and fixed in the usual manner. The print, after leaving the hypo-bath, is subjected to the action of a solution, which transforms the silver forming the image into silver oxide and at the same time entirely eliminates the hypo by chemical action. The colors used in the tinting are entirely new (albumen probably), and form part of Mr. Mayall's discovery. They are beautifully transparent, and when applied to the surface of the print unite with the image, forming a colored silver compound, which there is good reason

to believe is absolutely permanent. The print is then placed face upwards, in an air-tight box, into which silcon, in a state of impalpable powder, is blown. When this has subsided and formed a layer on the picture, it is carefully coated with salicylic acid, and the whole, image, leaves the paper support, and can be applied to the decoration of any colors and film unite to form a kind of flexible glass which, when dry, material. The process being altogether different from anything heretofore practiced, has at least a claim for novelty, and, as the pictures are said to possess rare beauty, there may be a popular future for them. But they are not photographs in natural colors as we understand that term. — *New York Photographic Times.*

The Sewage System for San Diego, Cal. — The *Sanitary News* describes a somewhat novel plan for disposing of sewage in the system which Colonel Waring has engaged to build for San Diego, Cal., at a cost of about $400,000. The main sewer runs a quarter of a mile into the harbor to an outlet-reservoir constructed alongside the deep ship-channel. The reservoir will have an area of one acre, and cost some $50,000. The collected sewage will fill this reservoir not more than one-and-a-half feet deep. High tide will add three-and-a-half feet of sea-water to the mass. The contents thus diluted will be discharged into the outgoing tide by automatic gates opening an hour after high tide, and closing an hour before low tide. At Stockton and Sacramento, where the conditions are nearly identical, Colonel Waring will make wells in various flat parts of the cities, connecting with a deep outlet-well by large siphons Colonel Waring has used this plan for two years successfully at Norfolk, Va. At Los Angeles he recommends the purchase of 10,000 acres of land six miles from the city, and the disposal of the sewage upon it by irrigation.

Gallic Burying Ground at St. Maur, France. — Archæologists and antiquarians will rejoice to hear that an important discovery has been made near the town of Adamville. A few days ago a Paris architect, M. Macé, was superintending some alterations in the Park of St. Maur when his men suddenly dug up some mouldering bones. The architect immediately stopped the works, and, jumping into the trench which had been dug, began to scoop out with his own hands what appeared to be parts of skeletons. He next disinterred an iron lance-head, the form of which and its incrustation of rust denoted its antiquity. M. Macé now set his men to work again, and they soon brought to light a large collection of swords, helms, lances, and bracelets. Next came a row of tombs, which looked as if they had been hastily built and arranged without order. It is supposed that the place was the burying ground of the Bagaudi, a tribe of ancient Gauls who were driven from the mountains of Auvergne, by Maximian, and were shut up in St. Maur. That town was, in fact, called St. Maur-les-Fosses, owing to the cuttings made by the Romans, and Adamville was known of old as the camp of the Bagaudi. The Bagaudi remained in possession of their intrenchment on the little peninsula of St. Maur, and their dead, who were numerous, were buried after the Romans left. It is also supposed that some of the famous Theban Legion, which was massacred by Diocletian, escaped to St. Maur. Some of the arms and bracelets which have been discovered are in a good state of preservation. — *London Daily Telegraph.*

Compensation for Injuries to Workmen. — At a recent meeting in Berlin of surgeons attached to railway workshops, a scale of unfitness for work was drawn up. A standard of 100 per cent was agreed to as representing the loss of both eyes, both arms or hands, both legs or feet, and one arm or hand and one foot. The remaining possible in juries were classified as follows: Right hand, 60 per cent; one foot, 50 per cent; left hand, 40 per cent; right thumb, 33⅓ per cent; one eye, 22 per cent; left thumb, 14 per cent; first finger of right hand, 14 per cent; first finger of left hand, 8 per cent; any other finger of right hand, 6 per cent; any other finger of left hand, 4 per cent. It is remarked by the *Colorist*, of Vienna, that the valuation of the right thumb at 11⅓ per cent more than one eye is curious.

Centennary Monument for New South Wales. — An imposing centennial monument is being planned by New South Wales. According to the model the memorial would be 100 feet high — a foot for each year of the colony's existence — and as broad as it is high; while all the material will be colonial. The rising sun will be at the top of the main structure, surmounted by a globe bearing a figure of Great Australia uniting the colonies. Four fountains represent the four great rivers of the colony, and allegorical figures and bas-reliefs, types of the respective natives, and designs illustrating the advance of New South Wales will adorn the monument. — *New York Evening Post.*

Measuring Deflection. — A novel method of measuring the deflection of railroad bridges has been tried in Russia. An iron pipe one-and-half inches in diameter was carried along the outside of one girder. From this pipe, on each abutment at the pier, and at five intermediate points in each span, vertical pipes of the same diameter branched out. Inside, and near the top of each vertical pipe, was fixed a graduated three-quarter-inch glass tube, the iron pipe being cut away on both sides. The zero divisions on the tubes were all the same distance above the flange of the girder. Before the bridge was loaded the apparatus was filled with water, the tops of the upright pipes covered over, and the water was then drawn off until it stood at zero in each guage. On the bridge being loaded the deflection could be read with ease.

Eucalyptus Roots. — A man dug a well 25 feet from a eucalyptus tree, lined it with cement, and placed over it a substantial cover. The water was carried to the house from the well in a wooden pipe. In that wooden pipe was a knot-hole. In time the well began to give out. The water, too, was acquiring a strange taste. Explorations developed the fact that the well had been filled up with masses of eucalyptus roots. The tree had run a root straight for the knot-hole, 25 feet off, and by that method gained the well itself. — *San Francisco Bulletin.*

Moulders' Sand. — The region around Albany, N. Y., furnishes the largest part of the moulding-sand used in the United States. It is found in deposits from one-and-one-half to two-and-one-half feet deep, for four or five miles back from the river on the west side of the Hudson, as far south as Coxsackie, and on both sides of the Mohawk up as far as Schenectady. There are three grades, brass and stove castings using the finest, and bridge-girders, etc., the coarsest. Along the Mohawk it is shipped in bulk in cars, elsewhere mostly in canal-boats and schooners; $500 per acre is often paid for the privilege of taking the sand from the land. In dry seasons it can be dug and shipped at once, but its quality is better when it is piled up and left over one winter. — *New York Evening Post.*

TRADE SURVEYS

The month of July has brought with it more business to the wholesalers and retailers than usual. Jobbers and travellers who are supposed to know the actual market conditions well have been saying all along that the summer business would be large and fairly remunerative in all channels of trade. Large buyers are unwilling to wait until the month of August before ordering supplies for the next three or four months, as is customary in many branches of trade, and for this encouraging reason that by that time it is probable the mills, shops, and factories of the United States will have their full capacity pretty well taken up. The greatest activity is among the manufacturers of all kinds of machinery and railway materials and supplies. Many railroad companies are unable to furnish cars or engines as fast as wanted, and since July 1 orders have been placed for nearly 200 large and small locomotives, besides a large number of cars and railway appliances. Inquiry at leading machinery centres and among the leading locomotive and car builders, shows that the activity in this direction is far behind the demands. There is greater activity in railroad building this month than last, and a rush of orders, such as in May or June, would have had the effect of advancing prices. Large consumers have about completed their estimates of requirements for the rest of the year. During the next thirty days the bulk of the requirements so far as estimated, will be covered. If we escape an advance until the middle of August it is not probable that fluctuations will occur after that date in the leading staple products. There is an undertone all through the market that the producing capacity will take care of consumers, and that no speculative advance is probable. The latest railroad earnings reported show an increase. Money is flowing both eastward and westward. Enterprise is not checked for want of encouragement. Building activity continues in all Western cities, and real-estate speculation has come to a stand where both sides will have a needed breathing spell. The iron trade is in a vigorous condition. A 25,000-ton lot of steel rails was taken by an American mill at $37.50 to keep it from going abroad. Contracts will be closed for 20,000 tons of bridge-iron this month to be erected in the winter on Eastern and Western rivers. Several orders for iron and steel have gone abroad, a result which is causing complaint among home iron interests. The anthracite coal trade will be 2,000,000 tons ahead of last years' output on August 1, by which time an advance of from ten to twenty-five per cent per ton will have been ordered on the remaining 14,000,000 tons of coal to be moved this year from that date. The bituminous trade East and West is expanding under the increasing manufacturing demand. The lumber-trade furnishes further evidences that prices are hardening, especially in the West and Northwest. As yet, the only effect in Eastern markets has been a hardening of prices in retail circles. All Western cities are absorbing lumber exceedingly fast. Kansas City alone will absorb 15,000,000 M. in buildings. A Lumbermans' Convention at Minneapolis advanced prices $1 per M., while a committee was appointed to consider the advisability of it.

The latest advices from architects in the interior seems to harmonize on the statement that prices of material and labor have not as yet discouraged house-building, but that manufacturing enterprise is looking ahead with some additional caution. Low prices encourage enterprise, and exceptionally high prices act as an inducement to await a reaction which business-experience and good judgment seem to anticipate. As a rule, the architects are busy. The solution of the labor-trouble in Chicago, practically speaking, is welcomed by thousands of builders, but there are not a few who would have preferred to see the question at issue fought out to the bitter end. This labor question can never be settled by unwise concessions or compromises. The iron and steel manufacturers of the United States tried concessions, and the result was and is the formation of a trades-union among the iron makers, whose expressed wish has for fifteen or more years been its edict. Labor at large, however, is more conservative. The fever of striking is subsiding. The leaders are anxious for a little rest. The conservative rank and file are becoming sick of assessments and of idleness. There is a feeling that has been smothered under the machinery of organization and lodge and assembly dictation, viz.. that of a desire for a direct and personal relation with employers. This tendency will grow, and is one of the internal influences that will check what might otherwise be the absolute supremacy of centralized labor authority. Each man desires to preserve a little remnant of independence, and there have recently been numerous evidences that this feeling exists. For the rest of the year it is probable that there will be little to disturb the friendly relations of employers and employed. The leaders prefer to husband their resources for another year.

The builders in all the larger cities are crowded with work. Investors have not felt like curtailing operations or of dropping projected enterprise. The brickmakers in all parts of the country are crowded for supplies. Late reports from marble and stone and slate quarries coming down to July 1 show a half year of almost phenomenal activity. Prices have not dropped to the almost unremunerative level of 1886. In fact, the opening of new sources of supply, and the liberal expenditure of money go to show the season has been exceptionally good. The better qualities of stone are contracted for far ahead, and the quarries will be worked to their fullest capacity. The old sources of supply have not suffered on account of the competition of the new. Architects encourage the increasing use of stone in dwelling houses, and there is a growing popular appreciation of stone over brick. Valuable beds of building-stone and of marble are being opened in the Southern States this year, and if the question of transportation does not interfere they will be developed on a large scale by the confident companies behind them.

The favorable crop reports, the light stocks, the heavy demand, the general confidence, all point to better conditions, though not necessarily wider margins. Production is being carefully organized, and each new screw and nut in this complex machinery helps to strengthen the intricate system of production and exchange, of which our industries are a part.

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CONTENTS

THE people who take an interest in the subject have for some months suspected that the "Colossal Organization" was in a bad way, and recent developments show that it is on the verge of collapse, if not of complete dissolution. A year ago the officials of the Order of Knights of Labor claimed that they ruled over a membership of a million. We do not imagine that there were ever anything like that number of members in the Order, or that the officials ever did, even if they could, make an accurate count of the membership, but there were at least a good many names on the rolls, and the managers, who seem to think that their duties consist principally in getting themselves interviewed by reporters and reading what the latter say about them, were full of smiles and brag. Now, the reporters who seek the presence of the magnates are repulsed with sour looks, and, instead of boasts about the power and prosperity of the Order, they are treated to muttered threats of the woes in store for "bankers," "capitalists," and various other persons. It would seem as if an official with a salary of five thousand dollars a year might speak with a certain forbearance about bankers and capitalists, and the asperity which the chief of the Colossal Organization shows towards persons who have saved up some money suggests the idea that perhaps his own income is in danger, and that his regret at not having laid by some capital in the time of prosperity shows itself, as usual, by the desire to injure those who have been more prudent. It is certain that the paid officials of the Knights of Labor have some reason to fear for their salaries. If they ever ruled over a million persons, they certainly control now little more than half that number. On every side the local organizations are withdrawing or disbanding, or returning their charters. In some cases, as in that of the carpet-weavers' association, the arbitrary interference of the chiefs of the Order with affairs that did not concern them has drawn several thousand members at once into revolt and desertion, while in other instances smaller assemblies, particularly in the lesser towns, where the native American element prevails, have returned their charters and disbanded, simply from "lack of interest," or, as we might perhaps interpret this phrase, from the innate dislike of Americans to subjecting themselves to irresponsible foreign authority. Taking all the defections together, the number of members who have withdrawn from the Colossal Organization since the strike on the Gould system of railways last year amounts to about four hundred thousand. That strike itself, which was promoted and maintained principally to exhibit the power of the autocrats of the Order in general, and, as we remember, of one in particular who afterwards escaped with the funds entrusted to him to carry on the contest, resulted in a violent revolt against the tyranny of the Philadelphia clique throughout the Southwest, and more than a hundred thousand men renounced their allegiance to it. The next great defection was that of the Cigar-makers' Union, comprising twenty-eight thousand men, who left the Order in a body on account of the interference of its officers with a local strike. Since then, many other associations, large and small, have withdrawn, and the course of the managers, who have apparently become desperate at the prospect before them, is now such as to alienate rapidly the remaining members of the Order. A few weeks ago an attempt was made to induce the Amalgamated Association of Iron and Steel Workers, a very powerful, and, on the whole, well-managed trade society, to join the Knights of Labor in a body. They considered the matter and declined, supposing that this would be the end of it. They reckoned without due appreciation of the power and disposition to do mischief of the chiefs of the Colossal Organization. A strike took place soon after, from local causes, in a steel-working town in Pennsylvania, and the leaders of the Knights of Labor immediately took advantage of it to deal a foul blow at the workingmen who had refused to submit to their supremacy by using all their facilities to bring non-union workmen to the spot to take the places of the men who had struck. With the resources which the Knights possessed a year ago, this would have been a terrible weapon of coercion, to force all workingmen into their ranks under pain of being thrown out of employment at the pleasure of the tyrants by means of a strike prepared for the purpose, but, fortunately for the people, it was apparently not thought of until the advanced stage of dissolution of the Order had made it comparatively harmless. Having now discovered it, however, the magnates seem disposed to use it indiscriminately, and within a day or two they have interfered in the same way in another strike in a New England town, collecting a full complement of new operatives for certain mills on the ground that "they were satisfied with the wages offered," thus displacing from their homes and their living, without any attempt at conciliation or support, several hundred poor people who, without their interference, could probably have settled their dispute by themselves. The unfortunates evicted in this way by their pretended champions were French Canadians, and those familiar with such labor can judge of the sincerity of the claim that they deserved to be driven from their homes for demanding wages in excess of the Knights of Labor standard. A few devotees may believe this explanation, but most people will see in the transaction simply another example of the seizing of a ridiculous pretext by a handful of mischievous and disappointed egotists, to show their remaining power by making a whole village miserable. It will not take many more exhibitions of this sort to complete the downfall of the Knights of Labor. We had rather expected to see the final extinction of the Order preceded by some particularly extensive and malicious demonstration, but there seems reason to hope that the rapid ebb of the power of the autocrats will leave them without resources to effect mischief before they can decide upon a plan of operations, and the people of the United States may congratulate themselves if the end of the Colossal Organization is a peaceful one.

THE history of the business of insuring plate-glass against breakage furnishes some curious statistics, as well as a good deal of information of value to architects and builders. It seems, from the Boston *Transcript*, that, notwithstanding the insignificant appearance of its business streets in comparison with those of New York or Chicago, Boston possesses more plate-glass, in proportion to its population, than any other city in the country, and the insurance companies find much employment there. At present, most of the insurance on glass is done by two companies, the Lloyd's Plate-glass Insurance Company and the Metropolitan Plate-glass Insurance Company, both of New York. The premium is a small percentage on the value of the glass—about two or two and one-half, we believe—and three-quarters of all the plates in Boston are said to be covered. It is estimated that there is one break a year in every eight windows insured, so that the premium does not seem unreasonably high. Losses are settled by the replacing of the glass, instead of a payment of money, and disputes are thus avoided, while the owner of the building and his tenants are spared the trouble of attending to the matter for themselves. In Boston, about one plate a day represents the loss to the companies, and the breakages occur from an almost infinite variety of causes. The usual cause is, naturally, stone-throwing of boys or men in the streets; and out of one thousand breakages, about three hundred are due to this. According to the statistics of the Lloyd's Company for 1885 the most active glass-breakers, next to stone-throwing boys, are burglars, who broke in that year about ten per

cent of all the sheets in Boston, which the company had to pay for. Pistol-shots produce many breakages, and, even in quiet Boston, about one plate is broken by a bullet for every four broken by stones. Next to missiles of various sorts, the wind is the greatest enemy of plate-glass, many lights being blown in by tempests, while many more are broken by the slamming of doors and blinds. Much less pains is taken to protect large lights in Boston than in New York, the rolling-shutters, so common in New York, being rare in Boston, but the premium rates are the same in both places, and perhaps the miscellaneous causes of destruction, which are accountable for thirteen per cent of the breakages, are more active in New York. One of the heaviest losses of the kind that we remember occurred in the latter city some years ago, where a large number of plates of different sizes, intended, we believe, for the front windows of the first story of a hotel, had been taken out of their boxes, and were placed against the wall of one of the rooms, ready for setting. The glaziers were at work, and one of them, looking for the particular light which he wanted next, found it in the interior of the stack, close to the wall. He tried to pull it out sideways, and in doing so tipped the rest of the plates forward. The whole mass fell to the floor with a crash, breaking every plate, and causing a loss of about five thousand dollars.

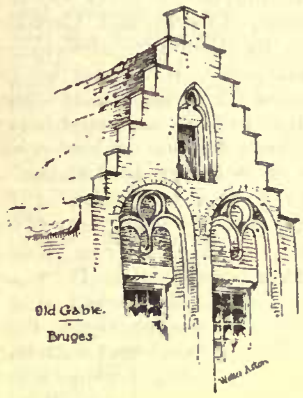
WE regret to have to report that the National Association of Master House-painters and Decorators has fallen foul of the architects, and in the recent Convention of the Association in New York, the members of our much-enduring profession were treated to a scoring which they will doubtless remember. The occasion of the chastisement seems to have been the propensity of architects to get painting work done as cheaply as possible, a tendency which was severely condemned by the Convention, although no method was indicated for correcting it, unless a hint of "boycotting" may be interpreted as significant of the policy to be adopted. The subject was introduced in the Convention by the reading of a paper written by Mr. Joseph Scott, of New York, on "The Relations of Painters to Architects." One would imagine that such an essay might present a very pleasant picture of the manner in which the interior and exterior of buildings may be made beautiful with color by the skilful artisan under the guiding inspiration of the designer of the structure, but instead of this the author complained that "the architect was now the autocrat of the building trades," and that he "took no account of the painter in the specifications," but consigned the man of brushes to the carpenter, "who was solely anxious to get the painting done as cheaply as possible." Why the architect should be to blame for the carpenter's desire to get the painting done at a low price we do not understand. Our impression had always been that in this respect the instincts of the carpenter and the architect were opposed, and that the latter, by requiring skilful work, and rejecting everything else, compelled contractors to employ trained painters instead of the bunglers who lay on white lead and oil for people who do not know enough to distinguish good work from bad. If the architects, by their disposition in this matter, have offended the master painters, the sooner they know what sort of conduct will be more satisfactory, the better for all parties. The complaint that architects take no account of painters in their specifications we can understand, but not credit. When we think of the hours of time, and of all the paper and ink, which we and our friends have consumed in writing painters' specifications, we are struck most painfully by the ingratitude of this charge. It is quite possible that the author of the essay may never have read the specifications prepared for him by architects, and, indeed, we have known some painters who seem to have supposed that architects specifications were not intended to be read, but this is hardly the architects' fault, and certainly should not expose them to public scorn as "autocrats," or other disagreeable things.

SOME time, perhaps not until the year 3000, the relics of our innumerable churches may perhaps afford as much interest to the archæologist of the period as those of the Roman Empire do to us. The Romans, like ourselves, were very tolerant of all sorts of religions, or, more probably, indifferent to them, so long as those who professed them did not meddle with politics; and Rome, with its temples of nearly all the Greek, Egyptian, Italian and Asiatic divinities, to say nothing of the modest meeting-places of the followers of the Nazarene prophet, or of Agrippa's enormous building, dedicated, very judiciously, to all the gods, without insidious discrimination between the true and the false ones, finds a very good parallel in New York, with its Catholic and Protestant churches of every sect and shade, its synagogues of Orthodox, Liberal and Christian Israelites, its Chinese Joss-houses, its Buddhist missionaries, and its radical and socialist organizations. What may be the future interpretation of the so-called Christian symbols with which our Ecclesiastical buildings are, as one might say, peppered, it would be curious to know; but our ancient predecessors seem to have used devices of their own sort almost as liberally as we do ours, to judge from a description in the *Builder* of the remains of a temple to the Persian deity Mithras, which has recently been discovered at Ostia, near Rome. Several temples to the same god have been found in Italy, and as this one, which is the best preserved of all, is attached to a private house, it would seem possible that the proprietor of the house, who appears to have had a Roman name, may have built the temple as a sort of private chapel, finding perhaps a new sensation, which would naturally be grateful to a rich Roman in a seaside watering-place like Ostia, in devoting himself, and converting his friends to the worship of a highly novel and interesting deity. Notwithstanding the novelty, however, the proprietor of the temple seems to have taken great pains, like most dilettanti, to get the details of his undertaking correct; and the mosaic floor of the temple is found to be covered with Mithraic symbols. The most conspicuous of these consists of a representation of a set of seven doors, which represent, by an imagery which, if not particularly subtle, is at least easy to understand, the seven degrees of initiation into the mysteries of the faith. To the doors are added the six planets and the twelve constellations, the amiable emblems of nearly every known religion; and a representation of a dagger serves to recall to the faithful the exploit of the god in killing a bull with such an instrument. Between the entrance door and the first symbolic door in the pavement is a sort of tank, probably covered at ordinary times, which the *Builder* thinks to have been the place for the baptism of the neophytes. This sort of symbolism, stupid as it seems, apparently gave great delight to the proprietor of the temple, and not only the floor, and what remains of the walls, but even the seats, of which there are two rows for the limited congregation, are covered with mosaics of the same sort. We are not much in the habit of designing stories, but it seems to us that a novelist of the romantic school might have a much worse subject than the experiences of the family of the rich convert to Mithras during the construction of his precious temple. A high-minded daughter, and a Christian lover, might be added to the properties of the drama, and the scenes between the rich old proconsul, and his friends who come down to view his religious hobby, with the repugnance of the noble girl, and the final triumphs of Christian sentiment, would afford opportunities for situations quite new to fiction.

M. BERTHELOT, the distinguished chemist, writes to the *Technologiste* some curious observations on the metals used by the ancient Chaldeans twenty-five hundred years ago. In 1854, M. Victor Place, in excavating the palace of Sargon, at Khorsabad, came upon the corner-stone of the building, in a cavity in which had been deposited, as is still the custom, a box containing inscribed tablets. According to the inscription on them, there must have been originally seven tablets, but three had disappeared, and the remaining four were brought to Paris and placed in the Louvre. On examination, one of these tablets proved to be of gold, still retaining its pure color. Another was of silver, easily recognized, although blackened on the surface; and a third was of bronze, almost destroyed by oxidation. The last tablet was of a dazzling whiteness, perfectly smooth and highly polished, and covered with small engraved characters. One theory considered the white substance to be an oxide of tin, formed by the corrosion of a plate of that metal; while another regarded it as oxide of antimony. The main difficulty which these theories presented to the mind of the chemist consisted in the fact that either antimony or tin, in oxidizing, would form on the surface a loose white powder, in which an inscription engraved on the original metal would be completely lost; while the engraving on the tablet was as distinct as on metal itself. An analysis was consequently made of a portion of the tablet, which showed that it was not composed of any metal or metallic oxide, but of a very rare mineral, the pure crystallized carbonate of magnesia, cut into shape, polished, perhaps with the aid of wax, since a trace of organic matter showed itself on calcination, and then engraved.

BUILDING ACCIDENTS.[1] — II.

TALL CHIMNEY-SHAFT ACCIDENTS. — WIND-PRESSURE.



ACCIDENTS to Chimney-shafts in Sheffield and Neighborhood during the Gale on Tuesday, December 16, 1878. — On this date, according to the local papers, there was a "terrific hurricane," which reached its height about 9 A. M., and destroyed a large amount of property, including many factory chimney-shafts.

The most serious was the destruction of a shaft in Grippet Lane, killing seven persons on the spot; three more died in the hospital two days after, five were seriously, and several others slightly, injured. The estimated damage in this case was £3,500, irrespective of a large stock of cutlery in process of manufacture. This square, brick chimney was built in 1858, and it was stated, at the inquest held upon the bodies of the killed, to have been from one hundred and fourteen to one hundred and sixteen feet high from the ground, and tapered one foot from base to top. The outside of shaft was of the best pressed bricks; the foundations were carried down four feet and built on rock, the cost of shaft complete being £300.

The erection of the chimney was commenced by the owner, a builder, and when a few yards had been erected an architect was called in to design an external elevation, with a cap, in terra-cotta, partly hollow: but he did not superintend its erection, as the proprietor, being a builder, did not require the services of a superintending architect; the shaft was, therefore, completed under the builder's own superintendence. While the chimney was being erected, he thought he would not carry it up to the height at first proposed, because he was of opinion it would be too high; he, however, was, he said, persuaded to do so. When the shaft was first built, it was noticed to oscillate, and ten years before it fell the town council had inquired into its stability, and the builder stated that he strengthened the base, which had the effect of considerably reducing the oscillation.

At the inquest, the architect was unable to give dimensions of the cap, as he gave the drawing to the builder and did not keep a copy. He stated there was a light balustrade at top, but could not form any idea as to its weight; it was, however, larger and higher than was customary. He had seen larger tops on chimneys, some, he believed, in Sheffield. The wind was the primary cause of its failure, but still there were chimneys in the town that withstood the gale.

A witness described the accident as being caused by the gale of wind overturning the shaft at its base, which, breaking again at the centre, fell across the workshops.

After deliberating half an hour, the jury returned a verdict that "the deceased died from injuries inflicted by the accidental falling of the chimney, and they further said the height and width of the chimney at top were too great for the width of base, and dangerous, and that the building of such chimneys should be discontinued in future."

This forms an instance of a shaft being commenced without, apparently, the slightest consideration of the proportion and design. As soon as the work commenced, the builder felt his inability to design the exterior, and engaged an architect to supply one: and, again, when the shaft was partially built, the builder lost confidence and thought he would not erect it to the first proposed height, but ultimately was, he said, persuaded to do so, the result being the chimney oscillated dangerously, and eventually collapsed.

During the same gale, as mentioned in the previous example, the following chimney-shafts were blown down, showing the wind to have had exceptional force:

Western Works (cutlery), *Portobello.*— Chimny fell, carrying with it a portion of the roof and otherwise doing a large amount of damage.

Mortar Mills, Willey Street, Wecker. — Chimney blown down and fell through roof.

Hallcar Works, Spital.— Heavy steel-toy manufactory, the chimney-stack fell upon the roof, completely smashing it. Four persons had a very narrow escape.

Bolsover Street, Palette-Knife Manufactory. — Engine-chimney fell through a workshop, across an adjoining yard and into a blade-maker's shop. One man was bruised about his legs and others narrowly escaped.

Phœnix Foundry, Furnace Hill.— Engine-chimney, sixty feet high, fell, nearly the whole of the débris falling through the roofs of two joiners' shops, and two shops occupied by fitters. Although the men were at work, singularly, they all escaped without personal injury.

Neptune Works, Watery Lane.— Button manufactory engine-chimney stack fell, the larger portion upon a new cutlery shop, and almost demolished it.

Milton Cutlery Works, Milton Street. — A large brick chimney fell upon the steam-pipes, communicating between the boiler and engine-houses. With commendable promptitude the "engine-tenter" pulled out the boiler fires. A large quantity of the bricks and rubbish fell onto a building and almost buried two men and one boy; all three were, fortunately, extricated without serious injury.

Norfolk Works, Saville Street.—A brick-chimney shaft, one hundred and twenty feet high, near the forging-shop and wire-mill, which had been noticed to sway much more than usual, broke about the middle and fell onto, and smashed, the roof of the hammer-shop and buried the machinery. Most of the workmen were, fortunately, away, but one man was jammed against a wall and almost covered by the fallen bricks; it took twenty minutes to extricate him, and he was badly injured. Another man, who was engaged in the stoke-hole, near the chimney, at the time of the accident, was severely scalded by steam from a pipe broken by the falling bricks, and crushed about the legs and body. A third man was also slightly injured. This accident wrecked one end of the hammer-shop, destroyed two large cranes, damaged some steam-hammers and a large quantity of tools.

LIGHTNING.

At Smethwick, near Birmingham, the soap-works chimney-shaft, originally three hundred and twelve feet high, has been struck five times by lightning: once during the building, when the chimney had reached about two hundred feet high, and four times since its completion. The proprietors say no very serious damage was done, but once, when, perhaps, the electric fluid was aided by the lime having been abstracted from the mortar by the action of the hydrochloric acid in the escaping gases. The owners were then compelled to take down a portion of the top. The latter four strokes all happened after the lightning-rod had been eaten away at the top by the hydrochloric acid, the remainder of the rod, however, being perfect. The rod was formed of one-half-inch iron, and, being eaten down only a few feet from the top, may have had the effect of diminishing the force of the lightning. The conductor has several times been renewed, but the action of the acid has been so rapid that it has soon destroyed the rod at the top, where it is exposed to the action of the escaping gases. In consequence of the top of the rod being so soon eaten away, the firm had the conductor coated with platinum, with very favorable results.

Whalley Bridge Printing Company, Lancashire. — The chimney at these works, which stands two hundred and forty feet high, was struck by lightning in November, 1878, which dislodged several tons of stonework. This shaft was furnished with a lightning-conductor, which had broken six feet from the top. The termination of the conductor being only some few yards in the dry ground, caused the lightning to rebound up to an office and, doing considerable damage, threw the manager on his back; the fluid following a course of heat into the drying-room, cracked a wall over a yard thick for twenty feet in length, and found its way into a dam and was there exhausted.

The conductor at top being broken, was the first cause of the accident, and the improper termination in the ground completed the disaster, so far as the lightning was concerned. In taking down the top, which weighed about twenty-five tons, for repairs, one of the large blocks of stone fell and caught one of the workmen on the chest, who, being rolled off the scaffolding, was killed. Fortunately, the staging on which the work was being done stood the shock and saved the masonry from dropping into the mill-yard below. The shaft, after being repaired, was provided with a new conductor, made of seven strands of No. 9 copper-wire and sufficiently long at the termination.

Oldham, Lancashire. — The King-Street-Mills chimney was struck by lightning in June, 1879, and was cracked down ninety feet. This chimney had been provided with a lightning-conductor, but, being old and rotten, it had dropped down from the holdfasts and was carried into the mill. The conductor and points stopped on the top of the shaft and conveyed the lightning safely from the top in its downward course, as far as the rod extended, but at the termination a hole several feet square was made by the lightning, through the shaft. Here is a case where it may be seen that had the conductor been in good condition it would have protected the chimney-shaft.

The Howard's Town-Mill Chimney, Glossop, was struck by lightning June 12, 1880, the brickwork falling from the top into the weaving-sheds, where all the hands were at work; one man only was hurt, and he not severely. There are four chimneys belonging to this firm, three of them being provided with lightning-conductors; the one struck was not so protected, it being thought the other three would answer for the one struck. The chimney was shattered for sixty feet down, and it took eight weeks to repair it, the works going on as usual all the time.

LARGE OVERHANGING CAPS.

The possibility of any accident occurring, or of any repairs being required to a tall chimney-cap should be one of the foremost considerations of the architect in designing, as the expense attending such work must necessarily be heavy.

Caps when finished should be a complete whole, or so bound together that the joints cannot open, and should be so proportioned that the centres of gravity of its respective component parts all fall within the outer circle of the shaft on which they rest. On no account should iron cramps be used with masonry as they will oxidise and burst the stone. Heavy and large caps are often the source of great danger, inconvenience and expense.

In one example we have inquired into, a heavy cap on a shaft at a fire-clay works at Huddersfield gave much trouble and expense to the owners. The original cap was a large overhanging one, many of the stones were blown down, and others decayed through the action of the acids emitted from the chimney. The whole cap had eventually to be removed and built up with purposely made fire-bricks. The

[1] Continued from No. 599, page 292.

firm estimate that the original cap in its erection, removal, etc., cost about £700, and from their experience are convinced no stone should be used at top, any oversailing to be gradually formed by hard-burnt radiated fire-bricks.

The ornamental chimney shafts of the Abbey Mills pumping-station of the Metropolitan Sewage Works, two hundred and thirty feet high, were originally finished at the top by a pyramidal structure, or capping of ornamental ironwork. The ironwork in each cap weighed as much as twenty tons, and was connected with the ground by a copper-tube lightning conductor. It having been found that the brickwork of the chimney was very much fissured by cracks, it was determined in 1883 that the ornamental iron-capping should be entirely removed, and the brickwork and masonry at the top strengthened by three bracings of iron. The removal, reconstruction of cap and repairs was successfully carried out by a London firm, the ascent being accomplished by "laddering" the shafts.

OSCILLATIONS.

It will be remembered that in many instances chimneys have been noticed to have had considerable oscillations previous to their downfall.

The writers have often heard it said that the rocking or oscillation of a chimney rather proves its stability than otherwise. How such an opinion can be held it is difficult to say. The slightest consideration of the subject one would think would condemn such an impression. When a shaft is oscillating, the mortar-joints and bricks are alternately subjected to tension and compression. Is there anything one can imagine more calculated to destroy the homogeneity of the structure, disintegrate the mortar and weaken the shafts? Further, by an oscillation the pressure is taken from one side and thrown wholly on the other, and by increasing the oscillation the resultant pressure would be so far thrown from the centre towards the side that the brickwork would be ultimately crushed and the shaft fall. Square shafts, it will be observed have, here, an advantage over round ones.

There is little doubt, that in the cases given the swaying of the shafts has gradually weakened the whole structure, so that the oscillation increased and ultimately overturned the chimney.

The heavier the material of which the shaft is built, the greater will be its stability, and the less possibility of swaying, as with a given diameter and height the stability increases directly as the weight, and the less the oscillation that will be caused by wind, the inertia of the mass being greater.

ACCIDENTS TO "STEEPLE JACKS" AND WORKMEN.

In November, 1871 a tall chimney was being erected for the Mossbay, Iron Company, Workington, Cumberland, and had reached a height of one hundred and fifty feet from ground. Four workmen entered a cage at the side to be drawn by an engine to the top by means of a rope passing over a pulley. At the height of fifty feet the rope broke and the four men fell to the ground, one being killed; another died shortly afterwards; the third had his thigh fractured and other serious injuries, and the fourth was much shaken.

In 1874 the lightning conductor to a chimney at a machinist's, in Huddersfield, Yorkshire, having been blown down, a portable ladder was being raised up the outside of the shaft to reinstate the conductor. The climber having reached a height of above eighty feet from ground, turned round to get to the back of the ladder, when the holdfast supporting it gave way and the man fell to the ground and was killed.

In August, 1883, a "steeple-jack" engaged in removing a portion of the top of a chimney at the Albion Cutlery Works, Green Lane, Sheffield, over-balanced himself, and fell to the ground, a distance of over seventy feet. Both arms were broken and the left leg fractured and shockingly bruised. He was taken to the Infirmary and died.

Fall of a chimney in Glasgow, two men killed. This accident occurred on Sunday, January 10, 1870, in the yard of a railway-wagon builder. The stalk, which was nearly one hundred feet high, had been deemed insecure, and the men killed were employed, with two others, in lightening the structure by taking twenty feet from the top. For this purpose cross-stays were erected inside the stalk, by means of which the men ascended to the top where they removed the bricks and dropped them down the inside, whence they were taken by the other two men at the bottom through an aperture which had been made about five feet high and three feet wide. While they were so engaged, the shaft suddenly gave way at the bottom. The result was, the men working aloft were both killed, but those at the bottom escaped without injury. The accident was said at the time to have been occasioned partly by the aperture made at the bottom of the shaft and partly by the weight of the men working at the top. These may have been the ultimate causes of the collapse, but the primary one no doubt existed, and the stalk *per se* must have been insecure, for two men at top and a hole three feet square to overthrow it, when it is remembered flues of this size are frequently left in shafts and workmen and hauling-tackle are at the summit during their construction and while the mortar is still green.

CAUSE OF ACCIDENT DOUBTFUL.

In the following example is illustrated the difficulty of arriving at the cause of some accidents. From the evidence given at the inquest, the shaft appeared to have been built in a most careful manner, but this evidence did not explain away the fact that the chimney fell. At the time an animated discussion took place in the technical journals, but without arriving at any conclusion as to the cause of the accident.

Northfleet Cement Works chimney disaster, October 2, 1873, six workmen killed and eight injured. Height of shaft from ground line, 220 feet; weight 1,674 tons, part forming cap nineteen tons three hundredweight. It was stated at the inquest that the materials used were of the very best, and the workmanship perfect. About sixty feet fell down without warning and apparently without cause. The chimney was described by the architect as being built with "half-brick" bond, which contains at least twice as many stretchers as would occur in old English bond. The same quality of brick was used throughout, and the mortar composed of the best Dorking gray-stone lime and Thames sand. At intervals of about three feet two courses of brickwork successively were built with the vertical joints dry and then grouted with neat Portland cement. The cap was formed entirely of brick in cement, and the cement here as elsewhere was of the best, and was used with a small quantity of mortar. The idea was that, though the ultimate strength of cement and sand might be as great, yet the cement and mortar would adhere to the bricks better at the beginning. Whatever may have been the cause, it appeared after the accident that a considerable part of this cement and mortar had not set with the firmness of the neat-cement grouting; and though it is hard to see how, on a quiet day, this imperfect setting could have caused the fall, it may have helped to make it possible.

This shaft was rebuilt according to the original design and finished in August, 1874. Special precautions were taken in the rebuilding to ensure that all the bricks were wetted before being laid, and that none of the mortar or cement should be worked up again after being spoiled or "killed." The same architect and contractor for the labor were employed, the proprietors supplying, as in the original shaft, their own materials. R. M. and F. J. Bancroft.

"ADOBE-TOWN."—PASO DEL NORTE, MEXICO.



Street in Adobe-Town.

It is a common saying on the borders of Mexico that "when you have seen one Mexican town you have seen them all." Of the towns where *adobe* is the only building material used this is quite true. A description of one would serve for a description of hundreds which might be named. As the basis of my description of "Adobe-town," I shall employ notes principally made in Paso del Norte, Mexico, the scene of an international episode several months since, and therefore well known, by name at least, to American readers.

Adobe is considered so characteristic of Mexico that it is often applied, by way of slang, by the Americans of the Southwest, to almost everything Mexican. Its application to the coinage of the country is quite general. The silver dollar of Mexico is currently known as an *adobe*, frequently contracted to *'dobie*. The dark-complexioned inhabitants of the country, some of the articles of food peculiar to the land, and even the language spoken there, are sometimes called "*adobe*."

An explanation of what an adobe really is may be unnecessary to the reader, but it may not be amiss to describe the simple process by which one is made, or rather *three* are made, for they are invariably moulded in triplets. The ordinary brown clayey soil is moistened in pits, and chopped straw is mixed with it. The worker—wearing a broad-brimmed straw hat and a suit of loose linen, with sleeves and trousers rolled up as far as possible, exposing limbs as brown as the soil in which he works—forms a picture worthy of Millet. In mixing the mud and straw he uses feet and hands freely, though tools of rude construction stand ready for use when absolutely needed. A simple wooden frame is used as a mould. It is wet thoroughly to prevent the mud from adhering to it. Being placed on the ground, straw having been first spread out to prevent the new and soft adobes from reuniting with the ground, the three compartments are quickly filled with the mud, which is smoothed off with the hands. The moulding-frame is raised, and three adobes, each about two feet long, a foot wide, and four inches thick, lie upon the ground ready to harden in the sun. In a day's time the ground is strewn with adobes. Under the direct rays of the sun the upper surface soon begins to dry. They are then turned up on edge, and other surfaces exposed. After several turnings, they are sufficiently hard to be used for building. Usually, the adobes are made upon the ground where the building is to be erected, and the adobe mud is used as mortar. Unless plastered, therefore, an adobe house is of

the same color as the soil upon which it stands. In such a case, it is not at first sight at all attractive. It is only upon intimate acquaintance that it is found to be not so dreary and cheerless as it at first seems. If surrounded by vegetation of some kind, it is not lacking in picturesque features.

In some localities the soil is such that adobes can be made which will prove quite durable — the reputed oldest building in the United States is an adobe dwelling in Santa Fé, New Mexico — for numerous specimens of adobe architecture exist in the southwestern part of our country, indeed as far north as the States of Kansas and Colorado, though Adobe-town, pure and simple, only exists at present within the borders of Mexico. Generally, however, a heavy rain softens adobe, and wherever heavy rains are prevalent, it is necessary to construct the buildings so that the walls will not be exposed to the weather.

A town of adobe naturally presents a very monotonous appearance. Plastering the exterior of the buildings prevents the walls from washing away in rainy weather and gives them a neater appearance, but does not relieve the monotony to any extent. The buildings are of one story, with flat roofs, from which water-spouts project at intervals of about eight feet. Every house is built around a *patio* or court-yard. An immense doorway leads from the street into the *patio*, and it is upon the *patio* that rooms open. Windows are not considered indispensable in Adobe-town, but when a building has them, they open directly upon the street, are as large as doors, and are covered with lattices of wrought-iron or sometimes of elaborately carved wood.

My feelings upon first looking into an adobe house which was to be my home for some length of time (two years as it afterwards transpired) are not to be forgotten, though they are not easily described. The door of my room opened directly upon the sidewalk which was two feet higher than the hard earth which composed my floor. The side walls were neatly whitewashed. There was a fire-place in one corner, otherwise the floor and walls were utterly blank. The ceiling was a curiosity: logs, stripped of the bark, were laid across the room forming rafters; over these were laid slender poles and over the poles a thatch composed of bamboo. The roof over this thatch



Mexican Ox-Cart.

was, like the floor and side walls, of adobe. Mexico it is well known, is a land of innumerable insects of venomous tendencies, so that the poles and thatch visible between my rafters were unpleasantly suggestive of snug harbors offered to centipedes and scorpions. On several occasions those insects actually did drop from these hiding places, but fortunately no accident occurred. Unattractive as this room was at first, it did not take long to become accustomed to it, and it was not difficult to so far improve its appearance as to make it both comfortable and inviting, so that when I finally turned my back upon it forever, it was not without some regret.

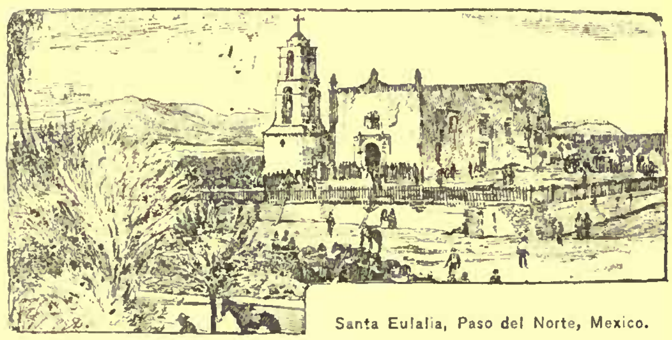
The comforts of an adobe house are briefly told. It is cool in summer and warm in winter. As usually built it possesses no windows. The doors and fireplace are the ventilators. All through Mexico the nights in winter are quite cool and the fireplace is quite as necessary for heat as for ventilation, and the *mesquite* roots used as fuel there make a fire which is both warm and in appearance cheerful.

The American colonist in Mexico will do well to accept the adobe as he finds it, or he may adapt it to his own ideas of comfort and beauty. The latter can be done by plastering the exterior and marking it off with lines to give it the appearance of stone; adding a peaked roof with an iron cresting which greatly adds to its outward elegance; putting in floors of wood (though it may be remarked in passing that the earthen floors seem generally free from dampness, of which they might at first be suspected); making a ceiling of domestic stretched upon frames, thus lessening the risks of having scorpions and centipedes drop from above; and using doors and windows of American manufacture. A gallery or piazza above should surround the *patio* and the *patio* itself will afford an excellent opportunity for floriculture. The result of this experiment will be a house suited to the climate and withal attractive within and without. Excepting for dressed lumber the expense of building such a house would be very small.

It has always seemed strange to me that after plastering the exterior of adobe buildings no effort should be made to select some color for them which would be agreeable to the eyes under the glare of a semi-tropical sun. The adobe buildings used by the officers of the garrison at Santa Fé, New Mexico, are thus painted with good effect, but in most Mexican towns the glare of the sun is intensified by reflection from walls of white. Nowhere does the eye rest upon an object that is not painful to the vision. That may be one reason why cataracts and other diseases of the eyes are so prevalent in Mexico.

Every Mexican town, large or small, has its *plaza*. It is the centre of its religious, social and business life. In it the band (and every Mexican town has its band) plays on stated occasions, and around it the people promenade. It is usually provided with seats of adobe or masonry arranged in concentric circles and quadrangles, and it is sometimes shaded with trees and made a *parterre* of roses. Upon it front the business houses, the residences of the richer citizens, and invariably the principle church.

It is the church of Santa Eulalia which dominates the plaza in our Adobe-town, — a curious structure worthy a minute description. Let the accompanying illustration suffice as to its exterior and surroundings. The interior is yet more curious. It contains a score of quaint objects, which it would be impossible to enumerate here. The sacristy contains quaintly carved chests of drawers, and church records going back to the year 1682. Back of the sacristy is an old lumber-room, filled with all sorts of articles used in the high religious functions frequently to be seen in Santa Eulalia. The ceiling of the church is an elaboration of the ceiling already described. The transverse beams are carved with a large lozenge pattern, in the



Santa Eulalia, Paso del Norte, Mexico.

centre of each lozenge being a many-petaled flower. To make this flower more flower-like, a carved peg about four inches in length is driven into it, to represent in a rude way the stamens and pistil. The effect of hundreds of these flowers is very singular. The ends of the rafters rest upon huge brackets also elaborately carved. The poles above the rafters are stripped of their bark, and are laid with great regularity diagonally across the rafters. All the woodwork of the church is hewn, and pulpit, chancel-rail, doors and choir are profusely carved. The carving is rudely done but time has softened some of the outlines, for, traditionally at least, the work was done two centuries ago.

The tower of Santa Eulalia is rather an innovation upon the prevailing style of architecture in Adobe-town and creates the suspicion that it is a comparatively recent structure, though the only way of reaching the gallery of the church is through the tower and over the roof of the wing to which it is attached. The spiral steps leading up into the belfry are of roughly hewn logs. A pole runs through the logs at one end fastening them together, one above another. The logs are spread out at the other end and embedded in the wall. The bells hanging in the arches of the tower are rung by means of cords fastened to the clappers.

Back of the church of Santa Eulalia is a row of buildings which might lay claim to historic interest. One of them was the prison of the American citizen whose arrest and imprisonment, about a year ago, was the subject of much discussion in two nations. The others were at one time the headquarters of the Mexican Republic: it was during the Empire when the French troops had driven the president from the city of Mexico and he sought refuge in Paso del Norte.

In one of the suburbs of Adobe-town stands an old adobe church which I used occasionally to visit, being attracted by the ludicrous effect produced by attempts recently made to renovate and modernize it. To that end modern wall-paper had been put upon the chancel walls — the design however being far from ecclesiastical. Upon the ceiling of the chancel were hung perforated and scalloped tissue-papers of various colors, such as are sometimes seen in corner-grocery stores. In lieu of pictures, upon the walls back of the altar, hung *seventeen mirrors* of different sizes and shapes. The Mexicans are fond of mirrors — there were five in my room in Adobe-town.

ARTHUR HOWARD NOLL.

A FORTIFIED CHURCH. — The little village of Landwehrhagen, near Münden, is among the very few in Germany which may still boast of a fortified church, dating back as far as the fifteenth century. The stone-work surrounding it, and chiefly protecting the entrance, contains a number of port-holes, and was strong enough in the Seven Years' War to withstand the attacks of the French, escaping with but little injury. In view of a recent decree of the communal authorities, ordering the destruction of this interesting historico-architectural relic of the Middle Ages, numerous petitions are in circulation favoring its preservation.— *Paris American Register.*

ILLUSTRATIONS

[*Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.*]

HOUSE OF H. A. C. TAYLOR, ESQ., NEWPORT, R. I. MESSRS. McKIM, MEAD & WHITE, ARCHITECTS, NEW YORK, N. Y.

[Hello-chrome, issued only with the Imperial Edition.]

AN EXHIBITION OF PEN-AND-INK DRAWING. BY MESSRS. F. H. BACON, BOSTON, MASS.; E. E. DEANE, BOSTON, MASS.; W. EYRE, JR., PHILADELPHIA, PA.; H. FENN, MONTCLAIR, N. J.; D. A. GREGG, BOSTON, MASS.; H. P. KIRBY, PITTSBURGH, PA.; B. LINFOOT, PHILADELPHIA, PA.; H. NEU, NEW YORK, N. Y.; J. C. STEVENS, PORTLAND, ME.; C. H. WALKER, BOSTON, MASS., AND J. D. WOODWARD, NEW YORK, N. Y.

IF any one be disposed to doubt whether or no the various architectural journals are doing anything to advance the art whose interests they are supposed to foster, let him turn back to the early volumes of the *American Architect*, for instance, and compare the results achieved by the best architectural draughtsmen of those days with the artistic renderings which the ever-increasing band of clever workers in pen-and-ink are nowadays capable of producing.

Having long been conscious of this advance, and believing that American work in this particular line was as good and interesting as any produced by artists of other nationalities, we conceived the idea that a good deal could be learned by studying the methods which artist-draughtsmen should employ in representing the same subject. Accordingly we invited a dozen artists — we forbear to use a qualifying adjective — to take part in an exhibition of pen-and-ink work, and it is with much pleasure and with no little gratitude to the contributors that we place the results before our readers this week; and, as the result is in our own eyes far more interesting than we had dared to hope, we trust that the ordinary quota of domestic architecture will not be missed.

Premising that these illustrations represent an exhibition pure and simple and in no sense a competition, we must say that in selecting those whom we desired to take part in the exhibition we picked from the ranks of the best workers those who seemed to have a pronounced individuality of style — that is, we refrained from asking certain persons to take part, simply because we had already secured a contribution from some one who worked in their favorite vein. In a general way the drawings have all the individuality we expected, and yet we are rather surprised to find that they can be very easily and properly grouped into three general classes. We will, however, leave each observer to make his own classification.

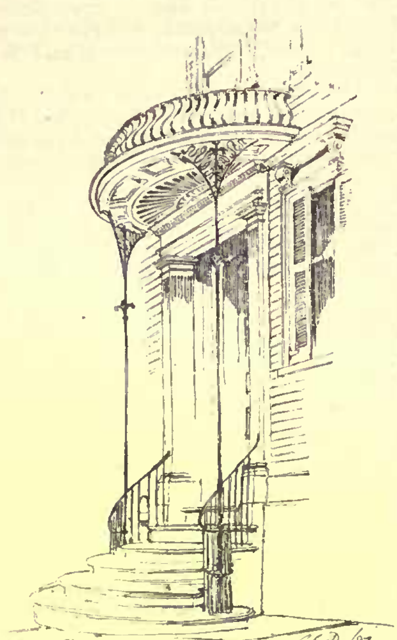
After having made our selection of architectural draughtsmen, it occurred to us that it would be interesting to see how artists of other professions would treat the subject, and we accordingly invited Mr. Harry Fenn and Mr. J. D. Woodward, both well-known illustrators, to take part. [Mr. Fenn began his artistic career as an engraver and Mr. Woodward as a landscape painter.] The drawings of these two gentlemen and those made by Mr. Gregg and Mr. Deane should be considered rather apart as the work of what we may style, for the moment, professional picture-makers in black and white, though the last-named gentlemen confine themselves almost wholly to architectural subjects. The other drawings are made by architects or draughtsmen to whom the making of a pen-and-ink drawing affords a grateful relief from the routine of daily office-work.

Each exhibitor was furnished with a small photograph of the subject and a sketch outline in blue — merely to secure the same size of drawing. The only suggestion offered by us as to how the subject should be treated was that each artist should make such a drawing as he would naturally make if he sat down with the subject itself before his eyes. We are sorry that we can say nothing more concerning the subject — a photo-caustic print of which is published with the drawings — than that it is situated somewhere in Normandy. Near what town it stands and for what purpose it was originally built we have not been able to discover. It was selected merely as being a good subject for our purpose.

A NORMAN VIEW — SUBJECT FOR A PEN-AND-INK DRAWING.

THE NEW ARCHÆOLOGICAL MUSEUM OF ROME. — The construction of a special archæological Museum at Rome is reported to be secured, the negotiations between the Italian Ministry of Public Instruction and the municipality of the city having come to a satisfactory termination. As the plans are already prepared, it is expected that a portion at least of the proposed building will be shortly completed, with a view of concentrating the abundant and valuable material which is now distributed in the various collections in Rome. The total cost of the buildings is estimated at 2,204,989 lire (£88,000), of which the Government will contribute two-thirds, the Municipality at most one-third. The site selected for the new museum lies between the Cœlian and the Esquiline. The museum, when finished in its entirety, is to receive all art treasures and antiquities already found; and all future discoveries in the city and province of Rome; but the collections contained in the Capitoline Museums are to be retained there intact. — *The Builder.*

DRAINING THE VALLEY OF MEXICO.



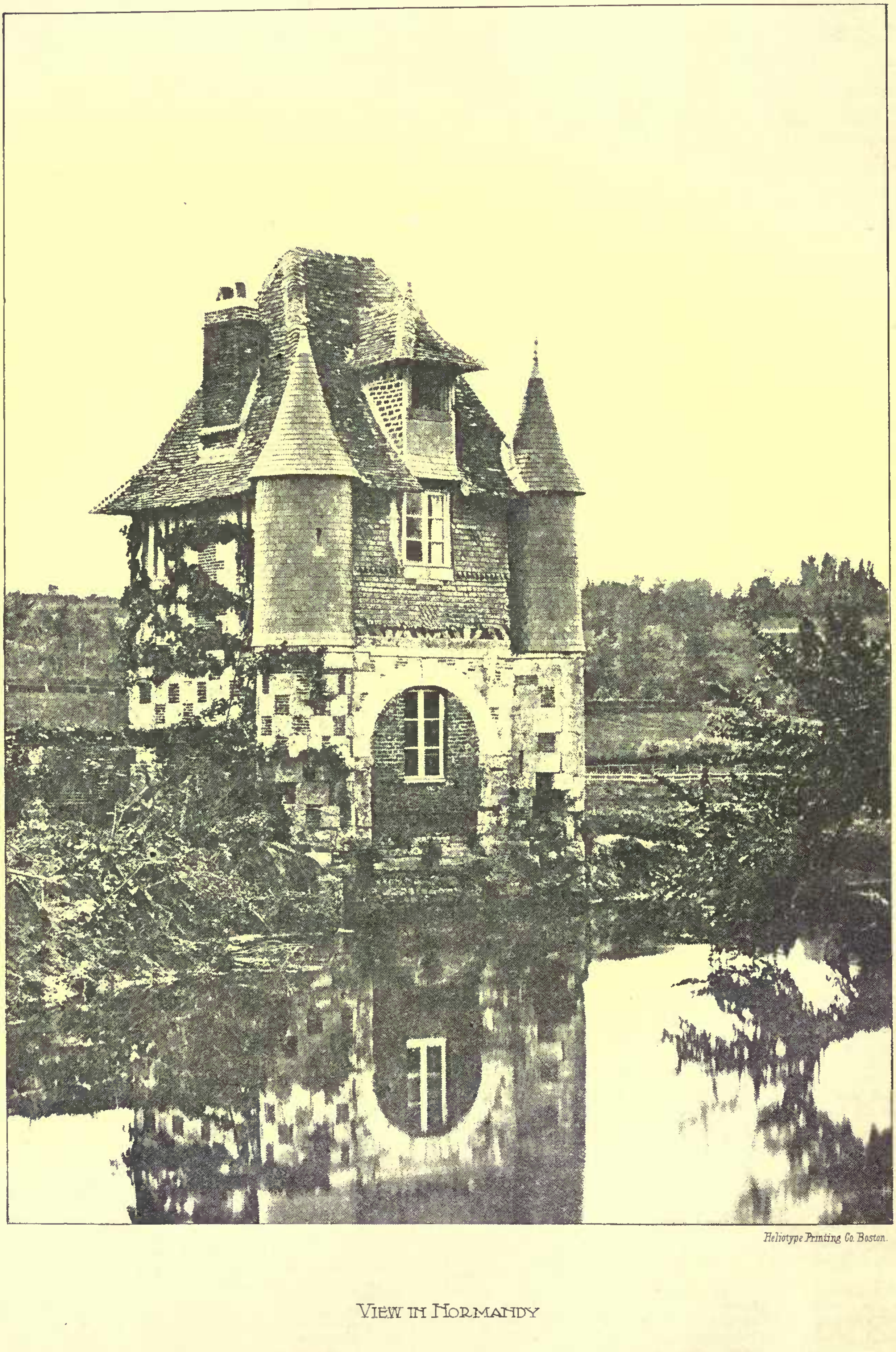
"A Doorway" in Providence, R.I.

FOR four centuries the waters of the firmament have been tumbling down each summer into the vast basin which the world knows as the valley of Mexico. The Aztecs had a lake city, a lacustrine metropolis, and as they did much of their locomotion in canoes and pleasure barges, they did not mind it very much; but when the Spanish conquerors built a stone city here, and filled up low lands and raised existing causeways, they undertook a battle against floods comparable only to the work of the Hollanders, who have made a kingdom out of what was the bed of the ocean. The Spaniards nor the Mexicans have been able as yet to do what the Hollanders have done, viz.: to make dry land where once was water. From the time of Humboldt down to the present year the question of the drainage of the Valley of Mexico has been the theme of learned men. It is acknowledged to be a great work, but is no longer regarded as stupendous, for modern machinery will dig the grand canal to carry off the waters of the lakes and give outlet to the annually recurring rains, and do it all in vastly less time than peon laborers. The Cleveland, O., company which has undertaken to dig this canal will soon be showing the dwellers in this valley the greatest spectacle they have ever witnessed, and will, with their huge excavating-machines, throw out dirt by the ton where a peon would be lugging a sack of earth on his back a few rods. So confident are the Bucyrus Construction Company of doing this work to the entire satisfaction of all concerned that they have accepted a contract for excavating only 1,000,000 cubic yards, trusting to proving the capacity of their machinery for getting the whole contract, except the tunnel through the mountains, which is to carry the water into a river, which will finally empty the city's drainage into the Gulf of Mexico. The tunnel is a government undertaking, and is likely to be put through rapidly. The magnitude of the task will be seen when it is said that some 1,300 square miles contribute their waters to swell the lakes which surround the city, and which at this moment are so full that for miles around they flood the country. It is almost by a miracle that the city escapes an inundation such as that famous one which, more than 250 years ago, submerged the streets of the capital and did not subside for four years, a most calamitous event, which depopulated the city and almost entirely destroyed commercial business here.

As the progress of the work of draining this valley, soon to be begun, will interest engineers and sanitarians the world over, I will give, in as brief space as possible, an account of the condition of this problem, as it presented itself in former times and as far back as the reigns of the later Aztec monarchs. The story is not a tiresome one, and is, in fact, occasionally somewhat humorous.

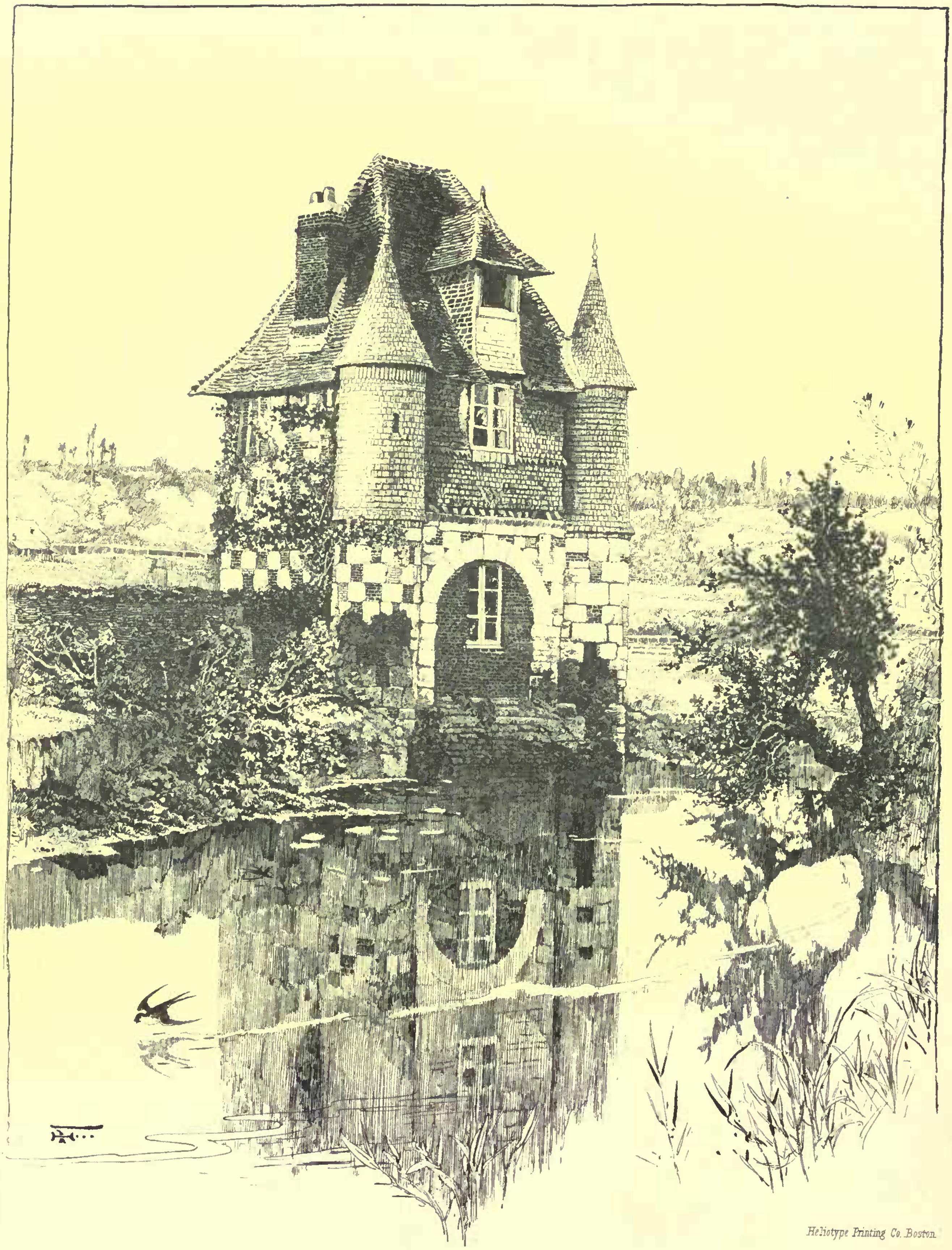
This City of Mexico was in ancient times situated in the midst of the brackish waters of Lake Texcoco, now withdrawn several miles from the town, and serving nowadays as a place of deposit for such part of the city's sewage as manages to reach the lake. At the time of the conquest the city was intersected by canals, crossed at intervals by wooden bridges. The canals were alive with boats and barges bringing to the market-place the vegetable and floral products of the surrounding country, building-material, poultry, etc. Many of the suburbs were built in the waters of the lake, being supported by piles, and the canoes of the householders were tied under their dwellings, into which access was had by a hole in the floor. On the waters of the lake were manœuvred the war fleets of the Aztec kings, and it was on this city-encircling lake that Cortez launched his brigantines for the siege of the capital. As has been said, the lake was brackish or salt, the saline quality arising from the presence in solution of muriate and carbonate of soda. This saltishness of Lake Texcoco is still its distinguishing quality, and even now the salt water of the lake, penetrating the soil under the city, make it difficult to maintain a healthy growth of trees here. As the trees grow and send their roots deeper they strike the salt water beneath and gradually die a wasting sort of death.

The Aztec City of Mexico was connected with the mainland by three huge dikes, or causeways, a sort of combined water-barrier and raised roadway, and a fourth dike led out to the island, now the hill, of Chapultepec. The Spaniards, on taking the city, threw down the great temple and demolished the stone edifices, casting the *debris*



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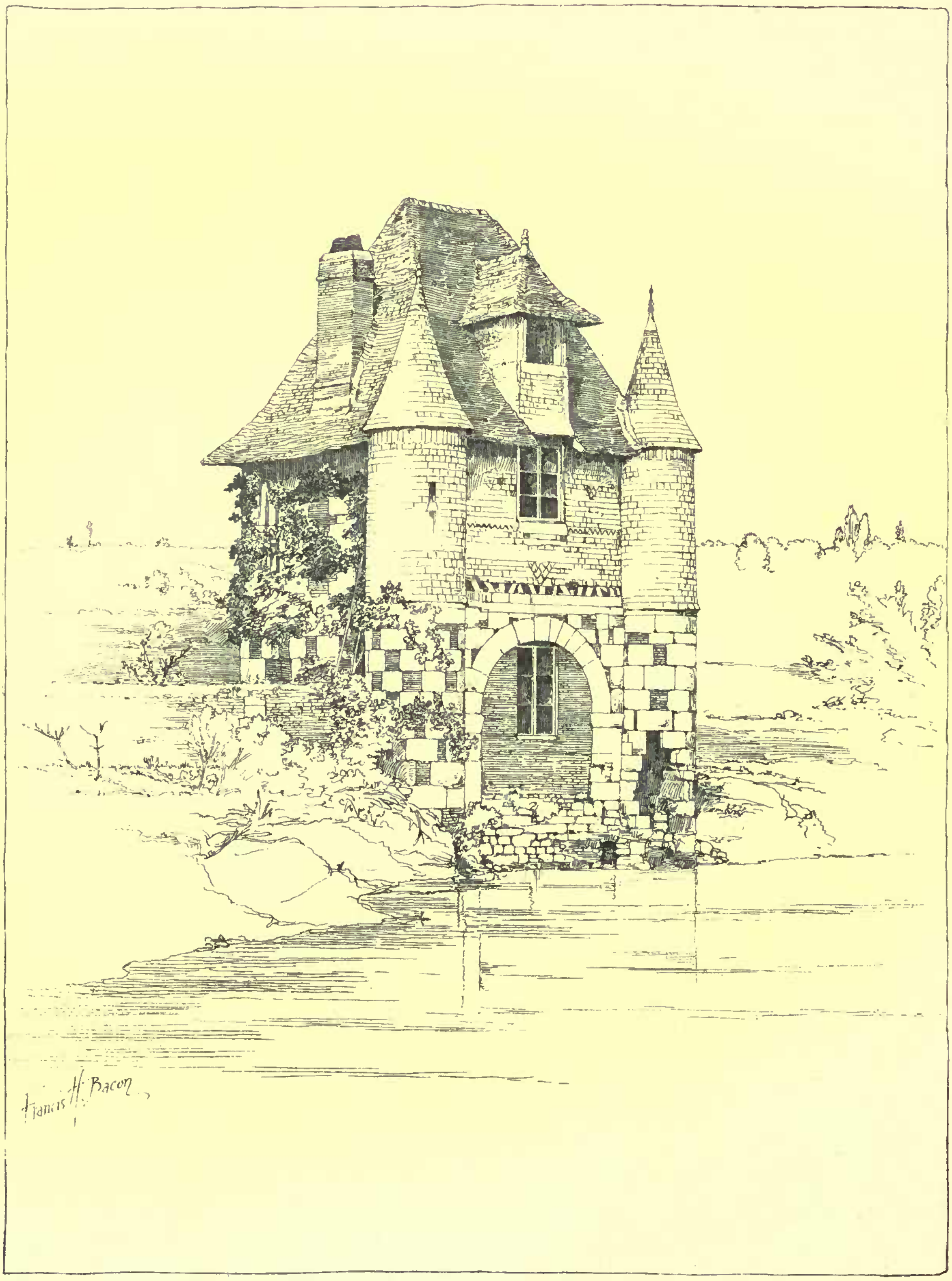
View in Normandy



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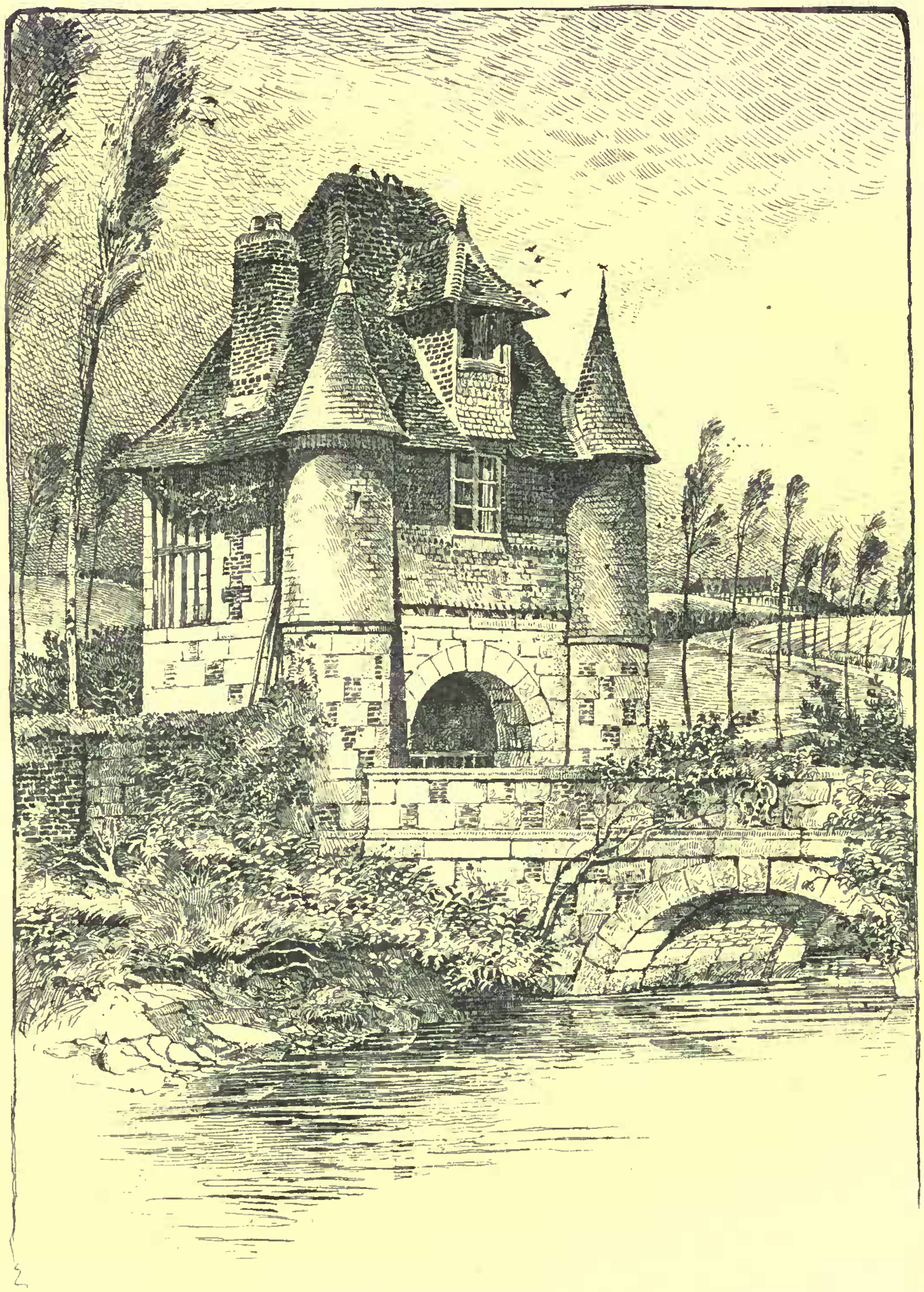
PEN-AND-INK DRAWING BY HARRY FENN.

No. 604 American Architect and Building News, July 23 1887.



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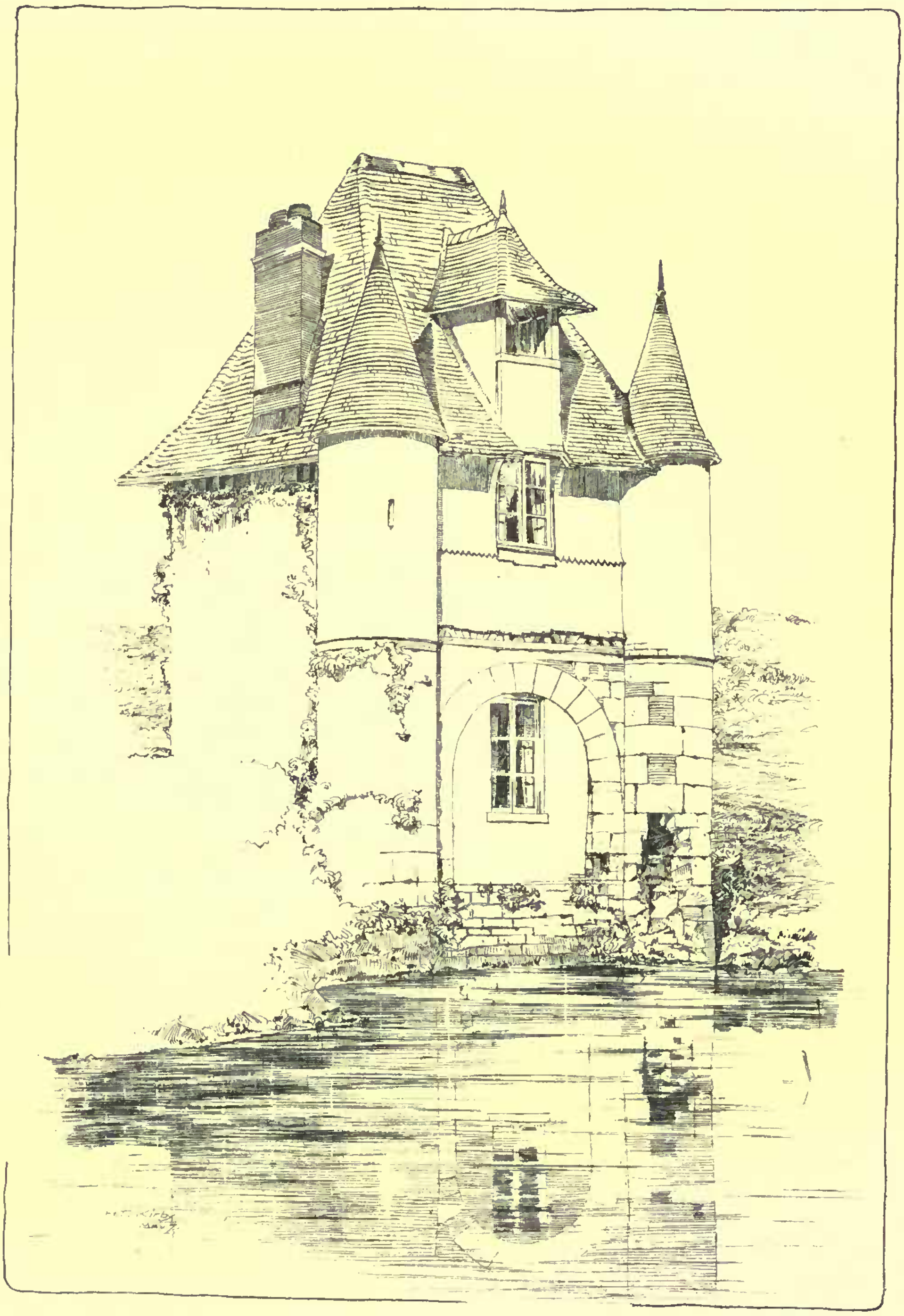
Pen-and-ink drawing by Francis H. Bacon



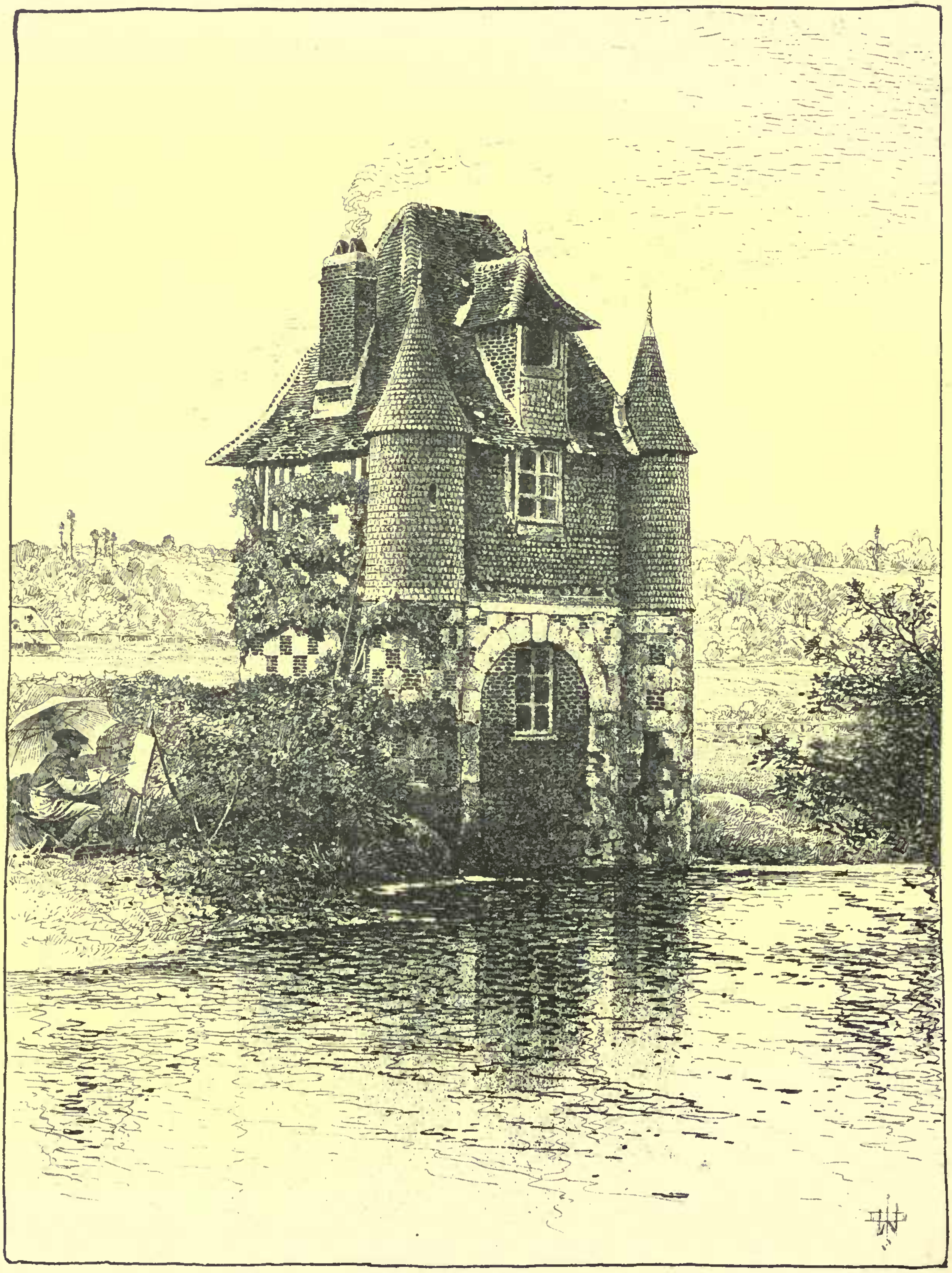
E. Eldon Deane.

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PEN-AND-INK DRAWING BY E. ELDON. DEANE

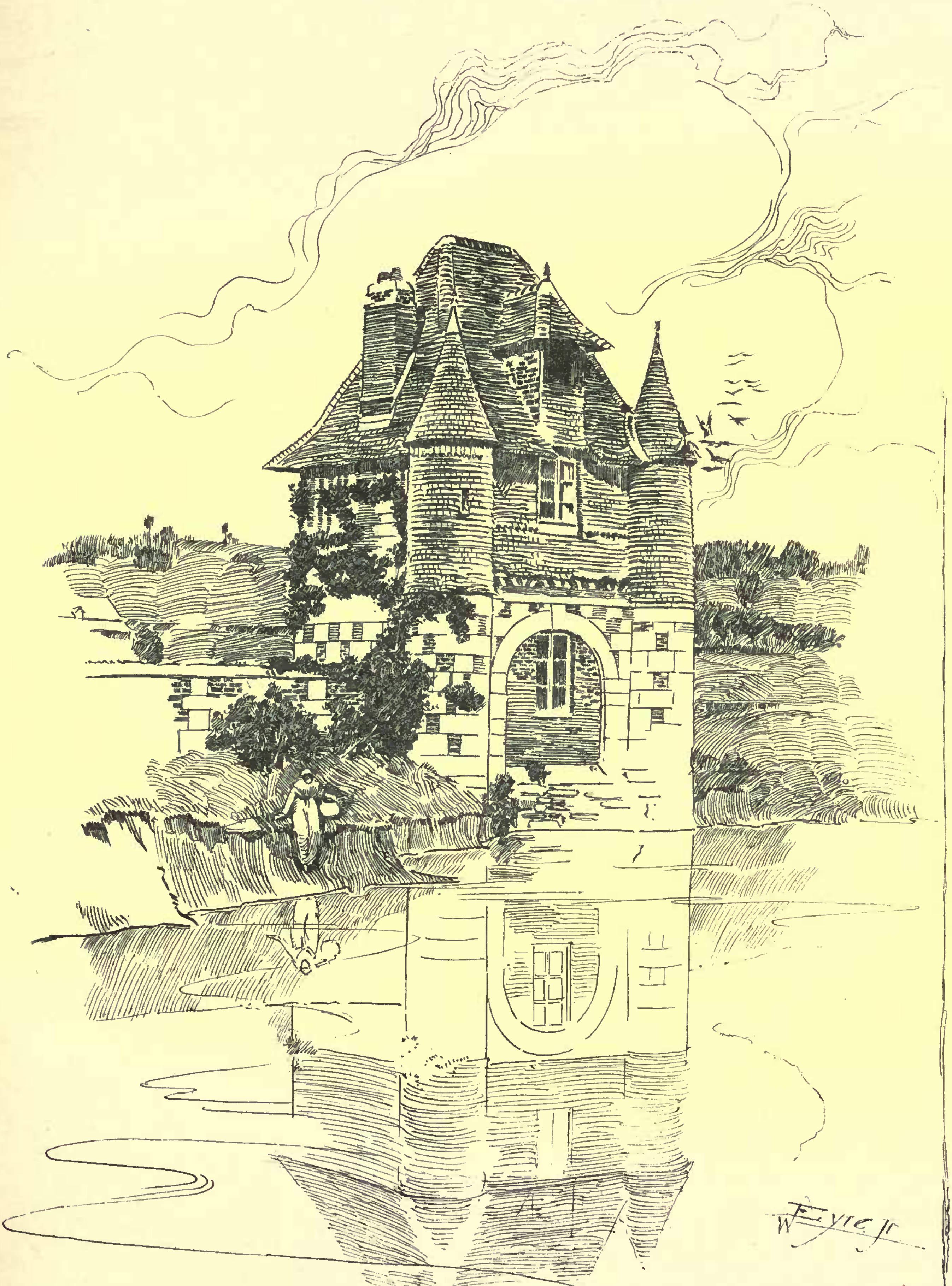


PEN-AND-INK DRAWING BY H.P. KIRBY.



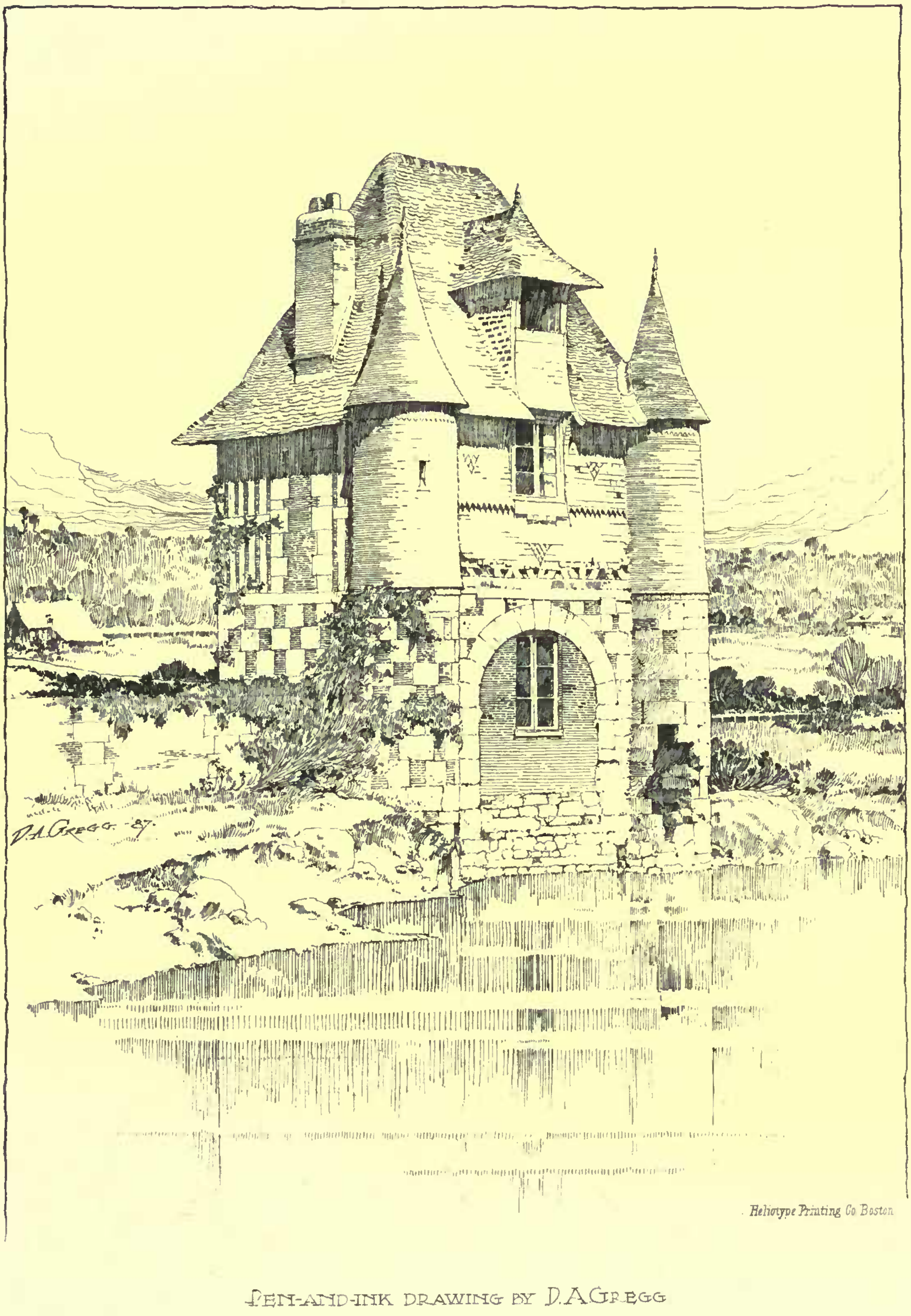
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Pen-and-ink drawing by J. D. Woodward.



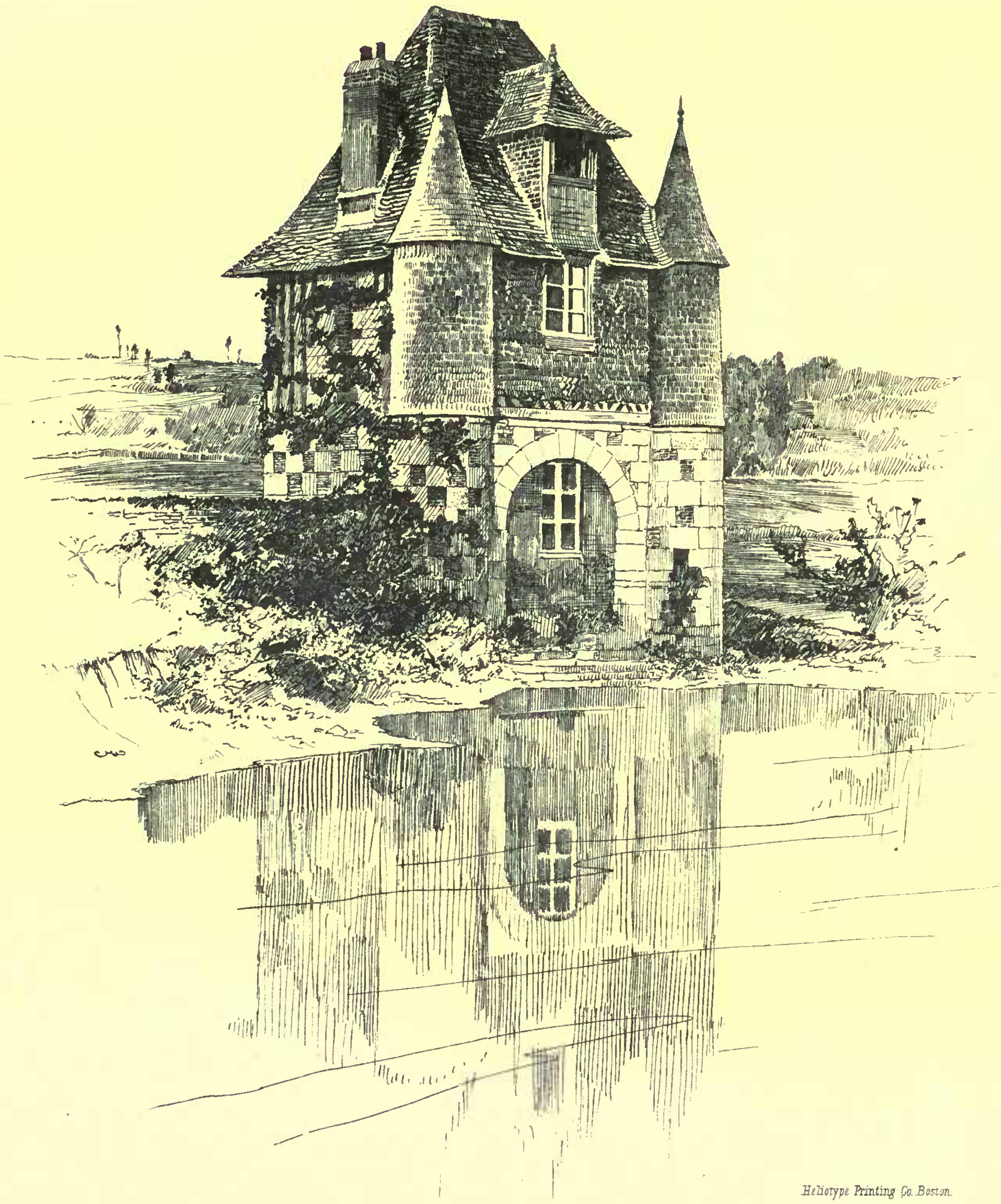
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PEN-AND-INK DRAWING BY WILSON EYRE JR.



PEN-AND-INK DRAWING BY D.A.GREGG

AMERICAN ARCHITECT AND BUILDING NEWS, JULY 23 1887. No. 604.



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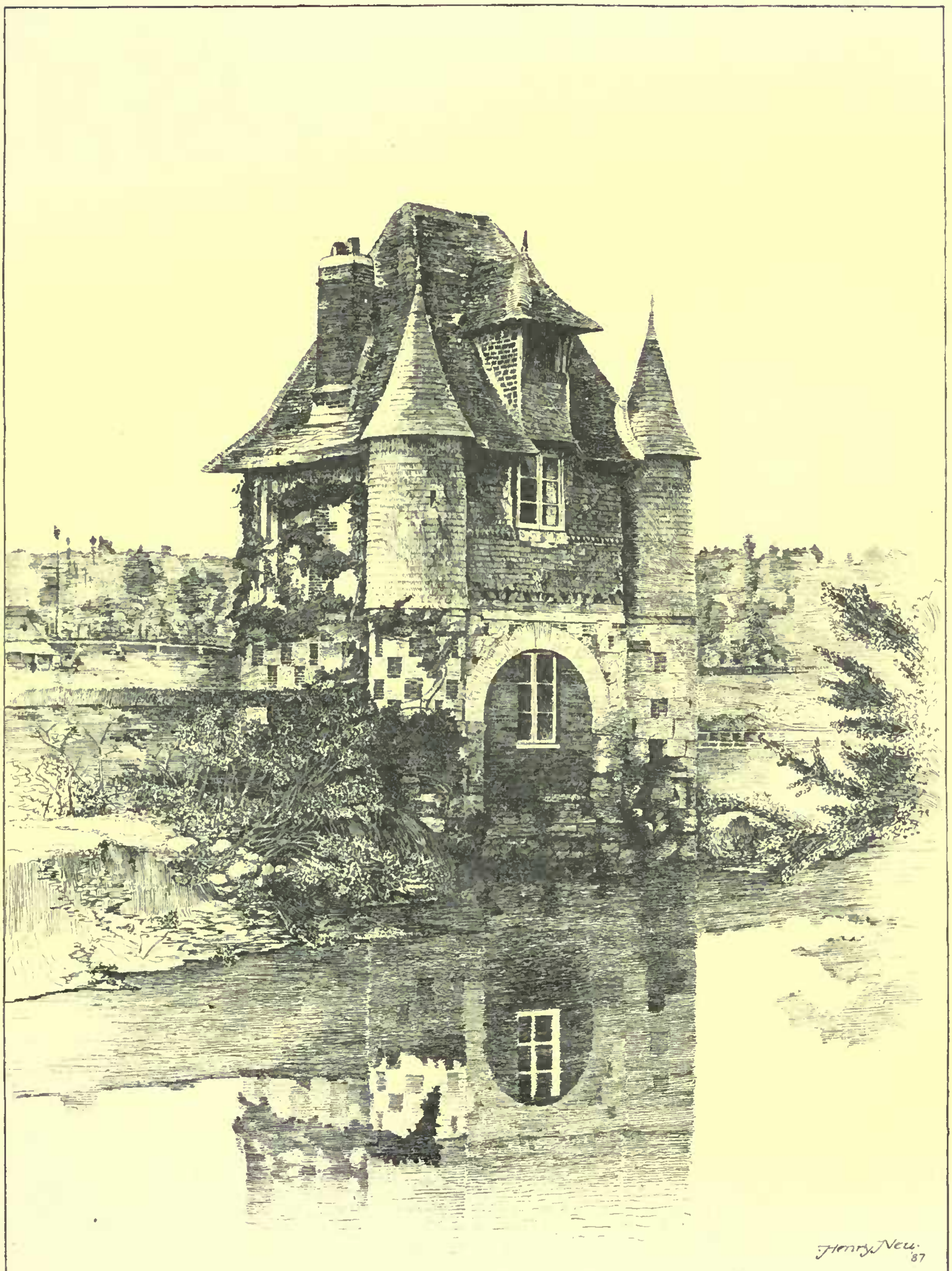
PEN-AND-INK DRAWING BY C. HOWARD WALKER

AMERICAN ARCHITECT AND BUILDING NEWS, JULY 23 1887. No. 604



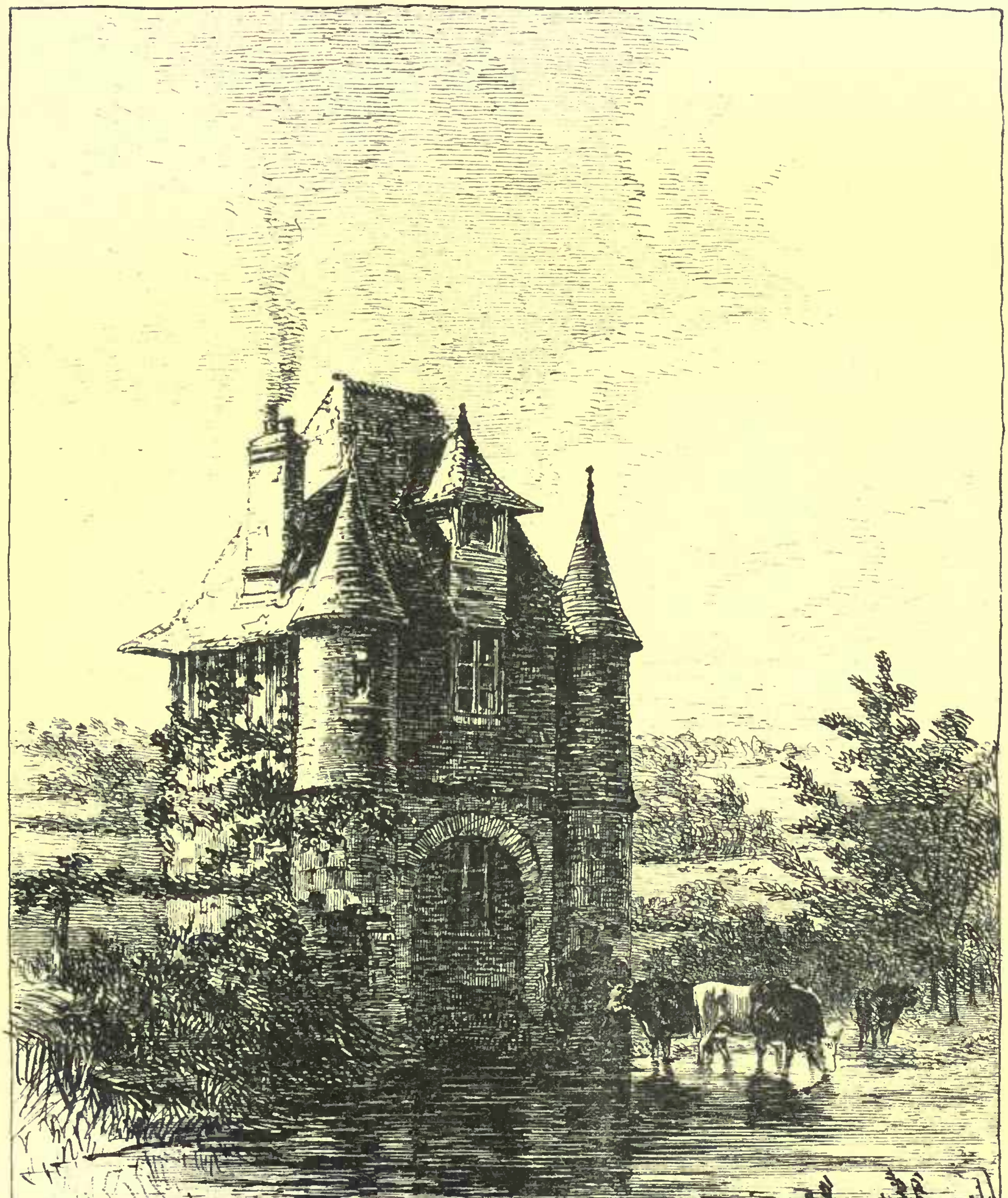
Heliotype Printing Co. Boston.

PEN-AND-INK DRAWING BY JOHN CALVIN STEVENS



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PEN-AND-INK DRAWING BY HENRY NEU



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PEN-AND-INK DRAWING BY BENJ LINFOOT.

into the canals, so as to make dry roadways of them. Thus, gradually, the Venice-like aspect of the city was destroyed and Mexico remained a compact sort of island in the midst of the lake. This Texcoco, salt, and alternately rising and falling according to the prevalence or abatement of the east winds, was regarded by Cortez and his companions as a sort of inland sea. An odd sort of sea, resting in the shallow basin fully 7,000 feet above the level of the ocean at Vera Cruz!

Even as an island, cut through by many navigable canals, Mexico was subjected to great floods, which, however, did comparatively little harm, as the houses were so raised as to prevent trouble in case of freshets. During the reign of King Ahuizotl the waters of Lake Texcoco had fallen so much that, to enable navigation to be kept up between Mexico and the city of Texcoco, on the eastern shore of the lake, an aqueduct was built to replenish it. Without doubt the reckless destruction of the forest trees in the valley and on the surrounding mountains, begun and kept up by the Spanish conquerors, had much to do with the later drying-up of so large a part of the lake. The Spaniards wanted the landscape to resemble that of the arid and bleak plains of Castile, and they worked with energy to denude the land of trees. How well they succeeded is now easy to be seen. And the process of drying-up the lake was hastened at the same time by the rapid evaporation due to the altitude and the tropical sun. When, later, the great drainage canal of Nochistongo was opened, the lake again felt the effects of carrying off those surplus waters of the higher level lakes which formerly had fed it every rainy season.

The lakes of the valley of Mexico are the natural basins into which flow the waters from the surrounding mountains. These lakes lie at different levels, and it was on account of their inequality of height that inundations occurred in the early history of the capital. The inundations all came in the same way. The Lake of Zumpango was first filled to overflowing by the summer rains and by the inflow of the waters of its swollen tributaries, and when Zumpango was full its waters rushed down into the Lake of San Cristobal. Then the floods from this overfull basin would burst the dike separating it from Lake Texcoco, lying at a lower level than the city, and Texcoco, swelling to huge dimensions, would send its surplus waters flowing over the plains of San Lazaro, penetrating into the city. The course of these ancient inundations was from the north and northwest, and the great cut of Nochistongo was made to carry off the surplus of Lake Zumpango which did such damage to dike and city. Although the lakes of Xochimilco and Chalco offer few dangers for the city, yet, should the snows of Popocatapetl be melted suddenly by heat, these lakes would so fill up as to flow over into the city. Texcoco, though lower than the city, is gradually filling up with solid sewage matter and mud, and as the level of the lake is thus rising, the danger to the city becomes every year greater.

It is very interesting to note the earliest operations to prevent the city getting too much water. The Aztec engineers started out by building dikes, as before shown, and great reliance was placed on these huge constructions, miles in length, and broad enough to enable an army to march thereon. Montezuma I. ordered the construction of these important hydraulic works. Later on, during the reign of King Ahuizotl, there came a great inundation, resulting from the monarch getting the notion into his head that he was a competent civil engineer. He undertook, as I have shown, to remedy the growing scarcity of water in Lake Texcoco, which then surrounded the city, and to this end built the supply aqueduct already noted. While he was going on with this work a citizen of some note at the capital, a man rejoicing in the odd name of Tzotmatzin, predicted publicly that the consequence of the King's work would be the flooding of the city. But Ahuizotl had got a very well developed case of "big head," and in his anger he ordered the unfortunate critic, who, perhaps, ran a newspaper, to be publicly killed as a warning to other captious people. So the work of building the supply-aqueduct went on, and when it was formally opened, the water came pouring into the lake, to the great joy of the merchants who traded with the translacustrine city of Texcoco. But Ahuizotl was soon made ridiculous enough, and the prediction of the sage Tzotmatzin was amply carried out. One day the heavy rains brought, *via* the supply-acqueduct, a great influx of water into Lake Texcoco, and the City of Mexico was flooded to such an extent that the hapless King Ahuizotl, waking up in the night, found his bedroom afloat, and had to swim for his life, and, in trying to find egress through an open door, was swirled about by the rapid current and cut his head. I imagine that at that moment the overconfident king did not think so much of his engineering qualifications.

After the conquest the dike system was kept up, but, notwithstanding the enormous amount of work put out on this sort of work, the city kept on getting flooded. At last the Spaniards found that they would have to abandon the Aztec engineering scheme and try something beside dikes. The city had, by that time, become a quite different place than it was under the Montezumas. It had a very few canals, and the people lived in houses built directly on the ground, and thus floods in the city were vastly more damaging than formerly. In 1607 the Spanish viceroy, the Marquis de Sallinas, engaged the services of a celebrated engineer, named Martinez, to undertake the drainage of the valley and the reduction of the volume of water in the lakes. Over half a century before a cut through the Nochistongo hills had been suggested, and Martinez took the idea up anew. On the 28th of November, 1607, in the presence of high civil and ecclesiastical functionaries, he began, with 15,000 Indians, the work of constructing a tunnel through the hills so as to give outlet to the waters. A year later he formally opened the tunnel, which was built of timbers supporting wooden cross-beams to keep the walls of the tunnel from caving in. The tunnel was about 20,000 feet in length. Some time after, it was found that the tunnel needed masonry, to keep the earth from tumbling in and filling it up, and archwork was put in at vast expense. But this work was done so unscientifically, the modern system of lining tunnels being unknown, that it led to a general caving-in of the work. In 1614 a Dutch civil engineer, one Adrian Boot, came over from Spain, and, after studying the situation, recommended protecting the city by dikes and mounds. His suggestions, however, bore no fruit. In 1629 Martinez perpetrated a bit of folly, only comparable to that of the conceited King Ahuizotl. Incensed at the many criticisms levelled against his tunnel, he had it stopped up, in order to give the people of the capital a demonstration of the needfulness of his work. The next morning a great part of the city was flooded, and so steadily rose the waters that it became a tremendous inundation, and for four years was Mexico flooded, causing, as was said at the first of this letter, a vast amount of damage. Canoes again became the regulation sort of thing, and bridges were built at places of convenience to the people.

The viceregal government went to studying the drainage problem all over again. They even tried bringing into the city the sacred image of Our Lady of Guadaloupe, but her presence did not have any apparent effect, and it was not till some earthquakes came along in 1634 that the ground opened and the waters disappeared. The damage to the buildings of the city was estimated at 1,300,000 livres, over $40,000,000.

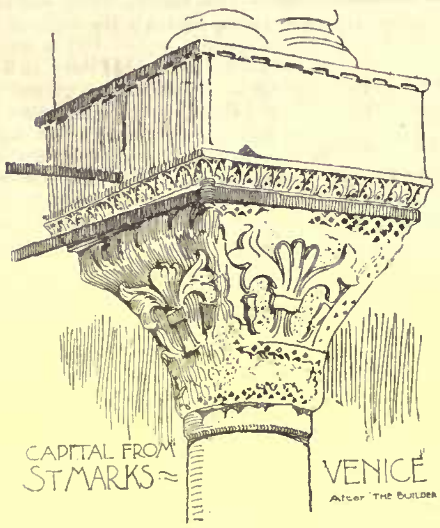
Finally, Cerral, who was then viceroy, ordered the release of Martinez from prison, and told him to go to work and perfect some plan for permanently relieving the city of danger of floods. A duty was put on wine consumed at the capital to meet the bills. Martinez puttered around for three years, accomplishing little, and his work was in 1637 put into the hands of a Franciscan monk, Fr. Louis Flores, who decided to abandon the idea of a tunnel at Nochistongo, and convert the work into an open cut. Somehow, the monks muddled the matter, and the history of the drainage projects for the next century is wearisome beyond endurance. There were all sorts of plans adopted, pushed for a time and then abandoned; whenever the lakes got very full, a panic would ensue, and there would be more digging at the great cut and renewed projects of dike construction. At last, in 1789, or one hundred and eighty-two years after Martinez began work on it, the cut of Nochistongo was opened substantially as it stands to-day. This cut of Nochistongo is familiar to thousands of Americans who have passed through it on the Central railway, which winds along a shelf of earth at a dizzy height above the trench in which the water runs far below. It is really a great engineering work, and if De Lesseps' descendants get through with the Panama canal in the same proportionate time, the opening ceremonies will occur some five centuries hence. The largest naval vessel could be floated in this cut, were it filled with water. It stands a monument to governmental procrastination and the blunderings of engineers.

I will not undertake to sketch the score of projects which have been considered in the last hundred years for the drainage of the valley of Mexico, nor will I go into details of the later plans of the Emperor Maximilian and his engineers, but will merely here state that Maximilian's tunnel will be an essential part of the scheme which the Cleveland company will work upon.

And all these centuries of effort, from the times of the Aztec kings down to the latest term of President Diaz, might have been avoided, had the Aztecs not been led by superstition to found their city in the midst of a lake, and had Cortez shown good sense enough to have built his capital at Tacubaya, on sloping land, out of all possible danger from floods. The valley of Mexico contains many better sites for a city than this undrained swamp, which at any point shows water if you dig from two to four feet, a city where to maintain a gas-service involves great expense, as the pipes are practically laid in water, and where no good system of drainage can be effected till the waters of the valley itself are drawn off. From King Ahuizotl to Engineer Shreve of Bucyrus, O., is a good distance in time, and we will await with interest the outcome of a plan which, if successful, will be one of the greatest achievements of the administration of President Diaz.— *F. R G., in the Boston Herald.*

The Silent Bell of Cologne. — The Imperial bell of Cologne, one of the largest in the world, is famous not alone for its dimensions and its powerful sound, but still more for its persistent — silence. For now upward of four years its bronze mouth has not spoken; in fact, the bell has never yet invited the faithful to service, because it remains thus far unblessed by the church, although the present incumbent of the archiepiscopal see has resided nearly two years within the shadow of the dome. Quite recently the architect of the Cathedral formally appealed to the ecclesiastical dignitary, Dr. Krementz, who, however, lays the blame upon the government authorities. In turn, the Minister of Worship has since been addressed on the subject of the bell, and it is now believed that he will ere long take the necessary steps to have it solemnly consecrated.— *The American Register.*

AVIGNON.



This famous spot, like many of its neighbors, is treated with a very undeserved neglect by the noble army of martyrs who yearly submit to the penance which they call "travelling for pleasure." Most of them are in such a hurry to reach Cannes, Nice, Mentone, or some other "eligible resort" along the Mediterranean seaboard that the few who happen to be awake when Avignon is passed think of it only as one more station left behind on the Lyons and Marseilles Railway, and are rather glad to get rid of it. Probably not one person in a hundred among the crowds who rush past it every summer and autumn ever thinks of halting there, and yet there are few places between the Gulf of Lyons and the Bay of Biscay which are better worth visiting.

At first sight, indeed, the famous city of the Rhone is anything but attractive in appearance. Still preserving its mediæval character beneath the thin varnish of modern improvement that overlays it, it forms a perfect cobweb of narrow, gloomy, winding lanes, walled-in and overshadowed by huge, dismal stone houses, and recalling at the first glance those open-air catacombs which pass for streets in Genoa and other towns of Northern Italy. Three men walking arm-in-arm would amply suffice to block any of these pipe-like "thoroughfares," and should you happen to encounter in one of them (as we did on the very night of our arrival) an ill-tempered cow or a pugnacious dog you must either turn back or take your chance of a fight, for it is absolutely impossible to pass unmolested. One can fancy what famous hacking and slashing there must have been here in the old fighting days of the fourteenth century, when the trains of two hostile nobles suddenly came face to face, like the Capulets and Montagues of Shakespeare, in one of these dark, narrow, crooked alleys. Swords were soon out in those days, and the first words of defiance were hardly uttered when the whole street was one whirl of tossing arms and flashing weapons, growing redder and redder as the press of fight swayed to and fro, while the good neighbors watched the sport approvingly from their windows overhead, and occasionally administered a little Christian charity in the form of a heavy stone or a broken tile to some wounded man who happened to have fallen conveniently just underneath the casement.

But the ancient town assumes a widely different aspect when you pass through the river gate in the freshness of early morning, climb the broad winding stair leading up the massive ramparts that front the Rhone, and look down upon the serried mass of roofs and the great plain around them over the trim iron balustrades of a pretty little public garden which is perched like a bird's nest on the top of the wall. Just below you, casting a grim shadow over the smooth, bright waters from the tall square tower that guards its central arch, lies the ruined bridge that figured so prominently in the English illustrated magazines last November in connection with the floods in Southern France. A few hundred yards farther down the stream stands the new bridge, flaunting its smart modern trimness in the face of its maimed and disabled rival. And now the roll of a drum breaks upon the still air, and from a solid stone fort that crowns a low round bluff on the other side of the river pour forth like a swarm of ants a long stream of tiny figures in dark blue whose bayonets glitter brightly in the morning sunshine.

This narrow belt of level ground between the foot of the wall and the brink of the Rhone witnessed 105 years ago a very strange and memorable spectacle. One fine morning in 1782, just about the time when many of the Frenchman who had been fighting for American independence were beginning to straggle home again, there was a great excitement in Avignon. Through the river gate the townspeople came pouring by hundreds and by thousands to crowd around a group of local officials and scientific experts who were standing on the bank beside a large silken bag, which was heaving and bulging in a curious way as if it were being gradually inflated with air. The better informed among the crowd eagerly announced to their neighbors that the two men who were so busy with this bag of silk—"two crazy fellows named Montgolfier"—had undertaken to send it up into the air as an experiment, having been foolish enough to assert the possibility of making similar bags of larger size navigate the sky just as ships navigate the sea, carrying with them a number of men fully equipped with all necessary stores and implements. The general laugh which greeted the thought of such an extravagant absurdity had scarcely died away when the unbelievers were confounded to see the silken case (which the "two crazy fellows" had fully inflated by this time) give one final heave and then sail slowly upward into the air, passing over the town at a height of several hundred feet. The first balloon had been launched into space, and the news of this achievement drew forth a few months later the last flash of that caustic wit which had made so many enemies for Frederick the Great:

> "The French in balloons as their own claim the air,
> The English will domineer over the sea,
> The land Russia has, and no morsel can spare,
> Then fire — there is nothing but fire left for me."

On the other side of the garden a steep, zigzag carriage-road leads down into the heart of the city, debouching at length on a broad open space surrounded by houses, upon which a few score of dapper little French grenadiers — who would stand a very poor chance against a bayonet charge of Bismarck's huge Pomeranians and sturdy Brandenburgers — are going through the evolutions of their morning parade. And here you come suddenly face to face with the most enduring monument of that formidable though short-lived importance which this strange old place possessed five centuries ago. All along one side of the parade ground rises a vast gloomy building of dark gray stone, wearying the eye with a profusion of pointed arches, and grim, massive towers and machicollated battlements and loopholed turrets and carved gateways and shadowy niches without order and without end.

From the presence of the soldiers, who are constantly passing in and out, you might guess this edifice to be a barrack, although its dismal aspect and the iron gratings upon its small, narrow windows would rather suggest the idea of a prison. It is, in fact, used as both, and the selection is doubly appropriate, for this building was once the ancient palace of the Popes who had abandoned Rome as a residence — spiritual barrack for the Church's soldiers, and a spiritual prison for the souls and consciences of mankind. Here subsequently to 1378 reigned a line of Pontiffs, who, supported by the French monarchy that had created them, stoutly proclaimed themselves to be the only true and infallible successors of St. Peter, and denounced as impostors and wolves in sheep's clothing the wearers of the triple crown of the Vatican. The trouble and perplexity of Christendom, while the Church which was the sheet-anchor of her faith was thus divided against itself, may be easily imagined. "Rome," says a great historian, "cried out against the corruptions of Avignon, while Avignon, with equal justice, recriminated upon Rome, and the many devout Catholics who were honestly anxious to reverence and obey the Pope as the vicegerent of God upon earth found it no easy matter to decide to which of the two worthless priests that were cursing and reviling each other the dignity of God's vicegerent really belonged." But unluckily for these latter Popes of Avignon — French anti-Popes as they are called — there were in France, during the stormy period of their denomination, certain daring spirits upon whom that familiarity which proverbially breeds contempt had produced its natural effect. Having seen what they could hardly avoid seeing, viz., that these spiritual despots, while claiming to hold the keys of heaven and of hell, were openly submitting to the dictation and obeying the commands of the King of France, the bold cavaliers of Bretagne and Normandy began to think, not without some show of reason, that the ecclesiastical thunders which had so manifestly proved powerless against their royal master would probably be equally ineffectual as regarded themselves. The result of this conviction was not slow to make itself felt. In the height of France's distress, when the dreadful wars of Edward III and the countless horrors that followed in their train were draining the very lifeblood of the unhappy kingdom, the Cardinals and other priestly dignitaries of Avignon — who, like many other "good shepherds" of that age, were fattening while their flock starved — heard one morning the watchman on the highest tower of the city rampart announce that an armed force had appeared in the distance, which seemed to be advancing straight upon the town. This of itself was such a common occurrence that nobody would have thought anything of it had it not speedily become evident that the troops were preparing to encamp under the walls, while a strong body of horsemen were riding at full speed up to the nearest gate.

Before any one could decide what was best to be done, a clang of armor and a trampling of hoofs echoed through the ancient town, and the daring intruders, riding along the narrow and perilous streets as fearlessly as if still in the open plain, halted in the open space fronting the Pope's palace, and silently ranged themselves in order before the great gateway. All were men of goodly stature and powerful frame, and all had their faces hidden by their closed helmets, excepting their leader himself. The latter, whose features were fully visible, was a short, thick-set, hideously ugly man in black armor, swaying in his brawny hand a ponderous battle-axe, which few ordinary men could have even lifted. Many looks of half-terrified admiration were cast at him from the crowd which had been gathered by the coming of the strangers, and the townspeople told each other in whispers that this could be no other than Bertrand du Guesclin, Constable of France, the bravest soldier and the best General of his time, who is still the hero of countless legends in every part of his native province.

And now three or four tall figures in black robes, issuing from the huge, shadowy gateway, demanded with a would-be menacing air who were those godless men that presumed to appear in arms before the Holy Father's own palace. But their assumed haughtiness

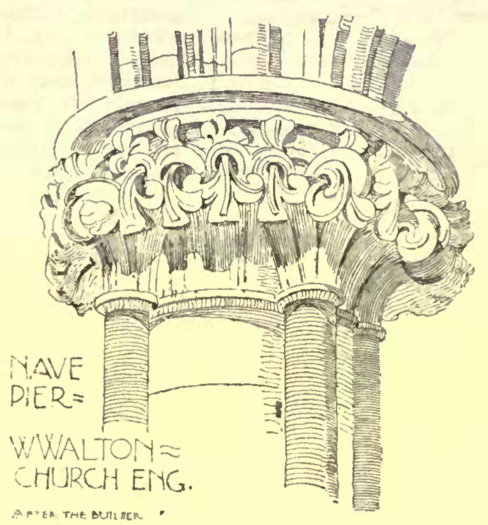
melted like snow before the stern soldierly bluntness with which du Gueselin replied that when the people had so long given money to the Church it would be only fair that the Church in its turn should give a little money to the people — that he had that very day ridden through four villages whose inhabitants were starving — that his own men were unpaid and hungry, and that, therefore, he Bertrand du Gueselin, as a true servant of his Holiness, the Pope, had come hither to ask the cardinals and clergy of the good town of Avignon to contribute somewhat from their abundance toward the necessities of their poorer brethren, and he trusted that they would not shame themselves and their master by refusing.

The significance of the ironical emphasis laid upon these last words was formidably pointed by the grim laugh that came rattling through the barred helmets of those armed statues who sat erect on their war-horses behind the speaker, and the papal envoys retired in a perturbation which extended itself throughout the entire palace as soon as the stern message became known. The wealthy churchmen were naturally indignant at finding themselves so unceremoniously called upon to pay taxes instead of receiving them; but, on the other hand, Bertrand du Gueselin was not a man to be trifled with. What was to be done? Several of the local dignitaries came forth in their richest robes and used their best rhetoric and their smoothest flattery to soften this stiff-necked "son of the church." But the stout Breton was not to be either convinced or cajoled. One inventive cardinal considerately proposed to raise the required sum by levying a "benevolence" upon the already impoverished people of the city; but the black frown which overspread du Gueselin's rugged features at the base suggestion palsied the words on the speaker's tongue before they were fully uttered. At length Bertrand, growing impatient, broke up the conference by declaring, with an ominous flourish of his terrible battle-axe, that if the money were not forthcoming within two hours he should know how to find it himself. There was no resisting such persuasion as this, and before the appointed time had expired the hero and his men were riding back to their camp with the full amount which they had demanded, pursued by a shower of elaborate Latin curses, which, coming from such a source, were probably quite as gratifying to du Gueslin as the subsequent blessings of the famished men among whom he divided the proceeds of this novel subscription.

Not many years later on in the same century there occurred another and even more striking illustration of the extent to which the prestige of the papacy had already been weakened, even during the period of its most overweening assumptions. A reckless French adventurer, the captain of one of those bands of "Free Companions," who were so very "free" that most people simply termed them robbers, finding that no more plunder was to be squeezed out of a country which war and pillage had turned into an absolute desert, was suddenly inspired with a new and brilliant idea. This was nothing more than to make a sudden dash upon Avignon, kidnap the Pope himself, put him to ransom, and then compel him to give his captors full absolution for the deed before letting him go. The chief's wild followers took up the project with professional enthusiasm, and for a while everything promised well for its complete success. One can scarcely help regretting that the world should have missed such an admirable opportunity of ascertaining the exact market value of a Pope in those days, and of learning how far it exceeded the £400,000 ($2,000,000), which the sale of Charles I by the Scotch three centuries later, established as the fair price of a king. But, as Carlisle has truly said, he who would keep a secret must conceal not merely the secret itself, but also the fact that he has one to conceal. One of the bandits, having allowed himself to be overcome by the good wine of the Rhone, began to boast with drunken exultation of the rich prize which he and his companions were about to capture. A quick-witted monk, who happened to be within hearing, lost no time in apprizing the Pope of the favor designed for him, and when the banditti came up to the gates of Avignon they found that the Holy Father had been forewarned of their intended visit and was "not at home."

But the ancient city of the Popes has other and more modern associations connected with it, the fame of which will probably outlast that of any Benedict or Innocent of them all. Not many, indeed, would care to linger over that hideous dungeon in the "Ice Tower," from the darkness of which one fatal morning during the fury of the Revolution the horror-stricken citizens dragged up "130 corpses" of men, women, and children, gashed and mangled by the sabres of Jourdan's red-capped murderers. But there are few American or English travellers who would not gladly turn away from the stately tomb of Pope Innocent VI or the ornamental shrine of Pope John XXII (the greatest villian that ever wore the triple crown, except, perhaps, Alexander VI himself), to the quiet cemetery in which stands a plain gray stone bearing the name of John Stuart Mill. The great logician and philosopher had his faults like other men — faults which his enemies exaggerated to the best of their small ability — but even those enemies were forced to admit the sterling quality of the material that underlay these trivial blemishes. History has already chronicled that when Mill's election to Parliament was swaying in the balance, and all the chances seemed to be against him, he was asked by an assembly of the workingmen upon whose votes his success depended whether he had not once said that the working classes are given to lying. "I did," answered Mill, without a moment's hesitation, and the hearty cheer which applauded the manly frankness of his confession proved that the sturdy artisans who heard it could recognize a true man when they saw him. — *David Ker, in the New York Times.*

THE RECENT PANIC IN NEW YORK.



WHAT the prosperity of the many is dependent on the prosperity of the individual, that one profession, trade or calling cannot continue to grow and prosper in a time of general stagnation and distress, and that the reverse of this proposition is equally true, is, perhaps, not often thought of in times like these, when everything is "booming." Architects, we take it, do not study the financial, stock and market reports unless they have some momentary interest in a single transaction. It may not be unwise, then, to show them how far their well-being is dependent on causes and conditions that have their growth far remote from the affairs with which they are habitually concerned, so it has seemed to us worth while to reproduce from the *Saturday Review* the following financial article, which is put in such simple language that every one can understand it, and by it be awakened to a realizing sense of how far the prosperity of a single individual of any nationality is affected by the great questions that are usually supposed to be the concern only of statesmen and great financiers:

The sudden and short-lived panic in New York on Friday of last week, and the depression in the stock markets which has continued since, are the result partly of the war scare in Europe early this year, and partly of the dearness and scarcity of loanable capital in the great cities of the Union. When the revival of trade in the United States began, about two years ago, there began also the buying of American railroad securities by European capitalists and speculators. The buying went on all through the autumn of 1885 and throughout the whole of last year, when suddenly Prince Bismarck's speech in the Reichstag alarmed the whole Continent for the peace of Europe, and a scare upon the Bourses and Stock Exchanges followed a few weeks later. The scare was particularly severe in Paris, and the selling extended, not only to all of what are called International securities, but to American railroad securities also; perhaps, indeed, it would be more correct to say that American railroad securities were sold on a much larger scale and more recklessly than anything else, because other securities were at times entirely unmarketable, and there were always buyers, at a price, of American railroad securities. The selling went on from every European capital; but, as we have said, it was especially large from Paris. It is asserted that a single Parisian great capitalist sold not far short of a million shares of American railroads in the course of a few weeks. The securities were bought almost entirely by the capitalists and speculators of New York, and they were bought, too, at a comparatively small fall in price. In New York it was then supposed that the question of war or peace would be very speedily decided; that if peace was assured confidence would at once return and securities would be bought back, leaving a handsome profit to the New York purchasers, while if war broke out it was assumed that capital would be remitted in very large amounts from those countries likely to be the theatre of operations, and would be invested for the greater part in American securities, as they would be entirely out of the range of hostilities. As a matter of fact, however, though peace has continued, uncertainty has not been put an end to. Every one now hopes that there will be no war, at any rate for this year; but everybody sees very clearly that all the conditions which made war appear imminent a few months ago exist to-day. There is thus no return of confidence, and consequently there has been no buying back by the sellers of January and February. The great capitalists and speculators of New York have found that the shares and bonds which they bought in such immense quantities at the beginning of the year remain on their hands, and that purchasers for them are not likely to come forward very early. They had bought, as we have said, in the confident expectation that they would be able to sell again very soon at a handsome profit, and they find their expectations disappointed, and no prospect of a demand for the securities at an early date. Of itself alone this was sure to bring about a fall in prices. The great capitalists, of course, can afford to wait. They know the value of the securities they bought; and, having once paid for them, they can put them away until a favorable moment returns. But speculators are not in the same comfortable position. They have to borrow the money with which they

buy; they cannot wait indefinitely, therefore, for a sale — sooner or later they are obliged to realize, and the condition of the New York money market has compelled numbers of them to end their speculation rather precipitately.

The extraordinary improvement in trade which has been going on for the past two years has, of course, been accompanied by a wild speculation in every direction. Railway building is being pushed forward more rapidly than ever before — which means, we need hardly say, that too much capital is being sunk in that form, and in too short a time. The iron trade and the coal trade are being stimulated by railway building. And house building in the great cities is being pushed forward rapidly. In thirty-five cities of the United States the estimated value of new buildings in the first five months of the current year shows an increase over the first five months of last year, of about 22 per cent; and in forty-three cities of the United States the estimated value of the transfers of real estate, also in the first five months of this year, shows an increase over the corresponding period of last year of about 52 per cent. All this clearly proves wild speculative building, and still wilder speculation in land. We know how reckless has been the speculation in wheat and coffee, and, in short, in every direction there is a mad speculation going on. All this creates an extraordinary demand for money. Cash is needed to pay work-people, to increase workshops, to provide the materials for railways, houses, and the like, and also for moving all sorts of commodities by railway. And the increase in the currency of the United States thereby required has led to an abnormal withdrawal of money from New York for all parts of the interior. The National Bank-law requires that National Banks shall always keep 25 per cent of their net deposits in cash. If they fail to do so the Government Inspector may require them to make up the amount within thirty days, and if they fail, may close the bank. The penalty, it will be seen, is a very severe one; but naturally it is not often enforced. Recently, however, a Government examiner, being dissatisfied with the securities held by a bank in Cincinnati, and being convinced that the directors and officers had been guilty of fraud, actually proceeded to close the bank, and declare it insolvent. This act of vigor on his part has naturally brought home to bank managers throughout the Union that at any moment they may be treated quite unceremoniously also if they infringe the law. Now, the demand for coin and notes all over the Union has drawn so heavily upon the resources of the banks associated in the Clearing House of New York, that out of about sixty-three, no more than three or four now hold in cash more than the 25 per cent of the net deposits required by law. In other words, only three or four of the banks in New York which hold the ultimate banking reserve of the United States are any longer in a position either to lend or to discount. They have to obey the law, and if they do not obey the law, they are liable to be closed within a month by a Government official. Being in this state it is easy to understand that several of those banks have been calling in loans. Probably it was the pressure put by bank managers upon those engaged in the "corner" in wheat and coffee that broke down those combinations, and there can be little doubt that the same kind of pressure had something to do with the panic in New York on Friday of last week, and with the fall in prices that has been since going on.

The demand for money because of the improvement in trade and the reckless speculation going on in all directions is not the only reason of the difficulty in which the Associated Banks of New York find themselves. As our readers are aware, the revenue of the United States greatly exceeds the expenditure, and the surplus has been employed ever since the close of the War in paying off debt. Within the past seven or eight years the surplus so applied has been enormous in magnitude, with the result that the debt has been redeemed at an unprecedentedly rapid rate. But the National Banks of the United States are allowed to issue notes only on condition of lodging as security in the Treasury interest-bearing bonds of the United States. Consequently, the redemption of debt by calling in bonds from the banks which had lodged them in the Treasury as security has compelled those banks to diminish their notes in circulation. There being no means in the United States by which a bank can recover and cancel notes issued by it, the banks which have been unable to do so are obliged to lodge in the Treasury an equivalent amount of Treasury notes or of coin; and thus there has been a contraction of the currency either in the form of bank-notes or of Treasury notes, or of gold and silver certificates, or of coin. Meanwhile all the bonds that can be called and redeemed at par have actually been called, and the last of them were to have been redeemed yesterday; and in consequence the surplus of revenue over expenditure has been accumulating in the Treasury. Thus the New York money market has been drained in two directions; money has been going from it into the Treasury, and going from it also into the interior for trade purposes, with the result, as we have said, that the greater part of the banks are unable for the time being to do the business for which they exist. Trade, however, is carried on chiefly by means of banking accommodation, and so is speculation; and when bankers are unable to give the accommodation which they were established to give, and which their customers naturally look to them to furnish, those customers are unable to carry on their transactions, and a breakdown in the speculative markets is a necessary consequence. Considering all things, the breakdown has been less than might reasonably have been expected. It is evident that the great capitalists must have exerted themselves very much to support the market, for we had a combination of circumstances which otherwise might have produced a panic — dear and scarce money; failures in wheat and coffee; one glaring bank failure, with a case of fraud; reports that numerous other banks were in a serious position; a vast speculation of every kind and in every direction, and a large quantity of bonds and shares bought months ago in the hope of being sold rapidly, and for which no market was available. Under these circumstances a very serious fall all round would not have been at all surprising. But the purely commercial conditions were highly favorable. Trade, as we have said, is improving in all directions; railway earnings are increasing at an extraordinarily rapid rate; dividend prospects consequently are good; confidence in the future is high, and, therefore, the great capitalists would appear to have come to the support of the market, and the crisis has been tided over with a much smaller fall and with much fewer failures than could reasonably have been looked for. Speculators, of course, took advantage of the combination of adverse conditions to force down prices for their own profit. Mr. Jay Gould has the credit of leadership and of having made large gains. But speculative manipulation could have done little, were it not for the scarcity and dearness of loanable capital and the political apprehensions that have disturbed Europe.

BOOKS AND PAPERS.

"INADEQUATE," "incomplete," and "inaccurate" are the alliterative adjectives that occur to us as we turn from this book,[1] which is the outcome of "twenty years of constant study." The time, perhaps, was not too long to devote to the preparation of an American glossary of architectural terms, but it is regrettable that more of it was not spent in weeding out from terms which purport to be first of all American, a great deal of rubbish that is antiquated, obsolete, or foreign to the tongues and understandings of Americans. We like to commend a book heartily when we can, and we often can and do, and we like to condemn a wholly bad book with equal heartiness; but this book falls entirely within neither category, and therefore must be treated in both ways.

First, then, it is commendable, as are most Chicago publications, for being well printed on fine paper, and bound in a substantial letherette binding, not the least of whose attractions is the design which ornaments the cover, a design which represents (pigeons and all) a drawing made in the office of Mr. T. P. Chandler, and published last year in the *American Architect*. Next, it is well arranged, and different spellings of the same term are bracketed together, prefixing a common definition. The illustrations being selected fragments of drawings published in other books and journals are attractive, and give a certain air to the book, This is about all that can be said honestly in praise of the book, though its greatest merit, its brevity, and the conciseness of its definitions must not be overlooked.

No book should be so keenly scrutinized or so severely criticised as a dictionary of terms, since in its accuracy lies its whole value; for if it is misleading in its definitions, those who rely on it are always at a disadvantage with others who have more trustworthy aids to turn to when a new word or phrase is encountered; so we feel that we ought to justify our introductory adjectives by explaining why it is that our hurried examination of the book has left check-marks on almost every page, which indicate inaccuracy of one kind or another.

Old English terms, Latin and Greek terms, French, German and Italian terms are fairly in place in a complete dictionary, but a "glossary," and particularly a glossary of American terms, would have been more serviceable if such rarely useful lore had been omitted. A single page, taken at random, contains these extraordinary words: Bubata, Buerania, Bulenteria, Bulker, Burton, Bustum, Caer, Calcatorium, Caloke, Camarila, Camaroris. What use has the audience to whom this book is addressed for definitions of such words? On those rare occasions when they are encountered, if the context does not give the clue, recourse can be had to a proper dictionary, or they can be skipped without much loss to the reader. In place of these words definitions of terms in common use should have been given as, for instance, of lewis, flitch-plate, lever, crab, crane, derrick, winch, and a hundred others which will occur to any one who spends half an hour in searching for omissions, for most tools, materials and processes have been neglected in favor of foreign and obsolete names of architectural members and features.

The inadequacy of the definitions is more amusing, though less harmful, than the incorrectness. Who, for instance, could detect that by "a metallic invention used in building" it was intended to declare the humble but useful *nail?* "Polychromy," it appears, is "a term synonymous with fresco painting." "Wrought-iron" is "pure iron in a natural [*sic*] state." A "joiner" is "a carpenter or builder." "Flamboyant" is "a name given to French-Gothic art." A "cylinder" is "a figure having a circular plan" — a cone, for instance. We hope that no simple-minded architect intending to

[1] "*The American Glossary of Architectural Terms*," being a concise and comprehensive compilation of all terms used in the practice of architecture and the building arts: a complete dictionary of over three thousand terms, historical, descriptive, theoretical, mechanical. Illustrated by many selected and original drawings. By George O. Garnsey, architect, Editor of the *National Builder*, Chicago, Ill., 1887.

tell a lady client that she can easily have a "bath-tub" in a certain room may take Mr. Garnsey's word for it that he may properly intimate to her that in that room she may set up a "bagnio."

As samples of mistaken definition we quote "Anthemion" which is said to be "the spiral of the Ionic volute," and which is explained by a cut showing a *Roman* Ionic capital. It is now generally understood that this word indicates the honeysuckle ornament on the necking of a Greek Ionic capital. "Garrison" is said to be "a fort, citadel or castle." "Impluvium" is declared to be a "Roman cistern" instead of the exposed portion of the inner court of a Roman house. "Corbie steps" are given as "a corruption of corbel-table," whereas this is the Scotch name for the "crow steps," the distinguishing feature of stepped gables in Scotland and the Netherlands.

As samples of typographical inaccuracies we have "verandah," "frustrum," "valarium," "consol," "insulated" for "isolated." Of the blunders natural to a man who has never had or has not profited by a college education it is enough to point out that if a definition of the word "strix" was given there was no reason for giving a definition of its plural "striges."

It really seems to us that the first edition of this book is hardly worth buying, for it is not supposable that such a hasty glance as we have given (reading, perhaps, one definition in fifty) has discovered all the errors.

PHOTOGRAPHY and the allied arts which have done so much to popularize the cheaper forms of illustration and to bring to the public the works of the great masters without the element of excessive cost, which was such an obstacle in bygone times, have rather led us to forget or lose sight of the works of the engravers of past schools. Engraving itself has changed a great deal since photography has been employed as an adjunct to drawing. It is very seldom that one sees a pure line engraving produced by modern artists. By pure line we mean an engraving on copper made entirely with the burin without any of the seductive aids which modern engravers add to their work in the shape of mezzo-tints — process reproductions, and the like. Only in Paris is there any systematic school of engraving at present, and we believe that only in the Louvre itself is pure line engraving taught and practised. But, nevertheless, though photography has replaced engraving so largely as a process, public interest has never diminished for the works of the old artists of the sixteenth and seventeenth centuries. Those masters of engraving wrought with their burins, not merely thinking out the ideas of other people or tamely copying what other artists had put before them, but bringing their own personality to bear upon the art which they had undertaken, evolving a style of engraving which has never materially changed. Compare any two of the old engravings with the work of such magazines as *Harper's* or the *Century*, and the difference will be very strikingly made manifest. It is not in place here to discuss which is the better process, or whether, by imitating so largely the touch and texture of paintings the engravers have lost their own share of individuality in art; but certainly, every one will agree in admiration of the older styles.

Gerard Edèlinck,[1] perhaps the most famous of the French engravers of the past, though belonging by education and by his work to Paris, was born in Antwerp in 1640. Our biographer does not have very many facts to tell us about him any farther than that he was in the studio of Corneille Galle, at Antwerp, until he had exhausted all that the Flemish city could afford him, migrating after that to Paris where he established himself in association with a number of other Flemish artists, and immediately began to receive public notice as a skilful and artistic engraver. He became the intimate friend of Phillippe de Champaigne, and was taken up by Colbert and given every advantage for his art. With such high protection he had every opportunity that an artist could wish, and the best painters of his time, Le Brun, Mignard, and others, seem to have been only too glad to confide their best works to his care; indeed, it is owing to him perhaps more than to any other engraver that we are able so thoroughly to judge of the painters of his century. It is difficult to believe that while all other branches of art should have advanced so much since his time, the art of engraving has remained practically stationary, and that hardly any one since his time has in any way excelled him. Delaborde tells us that he got his great renown at the time as well as a great share of the admiration in which he is now held, from the power he possessed more than any other man of his time of subordinating himself entirely to the work he had before him, so that one can trace in his engravings the peculiar methods of the painter. At the same time he always had his full share of originality, and in reproducing a painting which had been carelessly or slightingly rendered in detail by the author, he would manage, by skilful use of his lines and lights and shadows, to bring out and accentuate the true intent of the artist, thus giving an added value to the work, while, at the same time, he secured the good will of the artist, who was naturally desirous of seeing his work represented in the best way. Possibly we should not consider this method an advantage now, for we are told constantly that the engraver must not think for himself, that he must not try to translate the painter's language into another tongue, but speak as the painter speaks. Certainly, the old masters never did this, either in Italy or in Germany. An engraving always has its peculiar qualities, which, while representing the picture faithfully, represented it, so to speak, in a different light, thereby adding a charm to it. Take any volume of the *Century* or *Harper's* and one who is at all accustomed to drawings can readily tell by an examination of the engraving in what medium the artist worked, whether in water-color, pen-and-ink, or pencil. It was never so with the old engravers. They used lines purely as such always, and there were few expressions which they could not obtain by the continuous flow of curves and straight lines. Engraving in those days was an art by itself besides being a process of reproduction.

Edèlinck was an exceedingly industrious man. There are more than three hundred and thirty plates in existence which were entirely engraved by him within the space of a little less than forty years — perhaps as much work as might be expected of all the engravers of his time put together. Our author tells us that he had very little help in his work, that all his engraving was by his own hand, and that the pupils, whom he had in numbers, never did anything upon the plates which Edèlinck signed, at least, to any more than put in a frame or a background. Edèlinck was one of the first members of the Académie Royale, an honor the more deserving of mention in that he was not a Frenchman by birth, and, indeed, could hardly speak the French language correctly. He was, also, if we are correctly informed, the first director of the Gobelins after Le Brun. He was allowed a lodging with a pension of fifty crowns, and the title of perpetual professor at the academy established for the instruction of artist weavers. He lived in the Gobelins, following his profession as engraver and directing the manufactory until his death in 1707.

Delaborde sums up his artistic qualities in saying that his works satisfied all the conditions of engraving, and that one may, therefore, in strict justice, consider him, if not the first, at least the most harmoniously organized and the most complete of all engravers. Were it not for the excellent engravings which accompany this biography, all of them taken directly from the works of the master, it would be a weariness to the flesh to undertake the reading of it, for M. Delaborde is anything but an entertaining writer, and he wastes so many pages in idle speculation as to what Edèlinck might have done, or what may have been his artistic inspirations and guiding forces that we are tempted to believe he did not know very much about it, and doubtless this is true, for even the best artists of Edèlinck's time lived comparatively obscure lives, and it is only by little incidental remarks here and there in current histories that we obtain any documents in regard to their lives. The biography is valuable as a document, and as an illustration of this best of French engravers, but it it hardly the work with which to while away a summer afternoon.

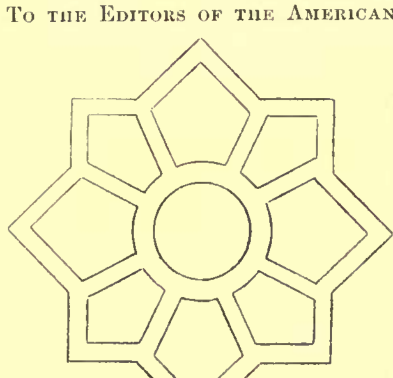
[1] "*Les Artistes Célèbres: Gérard Edèlinck*," par le Vte. Henri Delaborde. Paris; J. Rouam, Editeur.

COMMUNICATIONS

STAR-SHAPED CHIMNEYS.

LEICESTER ROAD, NEW BARNET, NEAR LONDON, June 30, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —



Dear Sirs, — In answer to your favor of May 28, *re*, star-shaped chimney: Some years ago I gave considerable attention to this section of shaft, and since receipt of your inquiries I have consulted with some eminent builders of this class of work. I cannot hear of a single example of such a shaft being built in England.

In my work on "*Tall Chimney Construction*," pages 101–102, I give an account of a similar shaft, 121 feet high, built for the Pennsylvania Railroad, West Philadelphia shops, illustrated by diagrams Nos. 54 to 59.

Experts on chimney-building in this country say they are more *costly* to erect, the corner or angle bricks require more care and labor in setting, and they catch much more wind, than if they had a *circular outer case*.

I have delayed answering your letter as I was anxious to get other opinions than my own. Yours faithfully,

R. M. BANCROFT.

THE "GUTTER-SNIPE" IN ARCHITECTURE.

NEW YORK, July 12, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — While engaged in superintending some work in this city, recently, a lad, inquiring for the owner and his address, handed the enclosed pamphlet to me, with a request that I give it to the owner. As the communication was sealed and addressed, I at once presented it to my client, who immediately returned it to me, together with some few remarks, which were not at all complimentary to the "compiler."

It would be interesting to me, as well as to many fellow-architects who have heard from the "compiler" in a similar way, to hear your views as to this method of increasing one's professional acquaintance.

Yours, etc., W.

[As might be guessed from the context, the "compiler" gives himself out as an architect, and the object of the compilation — a little pamphlet the cost of the manufacture of which is evidently borne by certain dealers in building materials who have placed advertisements in it — is to sell for $25 plans and specifications for a 16′ 8″ front house, and, if possible, the interior details of the same for an added $15, and again to obtain, still, if possible, $10 more for filing the plans and specifications with the proper authorities. What a professional man may with propriety do to extend his business and increase his income is a delicate question. But we feel that the line of decent behavior should be drawn at some perceptible distance from the pestiferous gutter-snipe. — Eds. American Architect.]

NOTES AND CLIPPINGS

Landslips in Switzerland. — The late accident at Zug recalls the more startling and much more fatal Goldau calamity of about 80 years ago. This Goldau lies at the other end of the Lake of Zug and is nestled in a valley lying between the Rigi on the one side and the steep Rossberg on the other. Both mountains are made up of conglomerate, interstratified with soft sand rock with the strata pitched at a very steep angle. The strata of softer rock disintegrate rapidly on exposure to the air, and at times become so charged with infiltered water that they are squeezed out by the weight above them and descend into the valleys as torrents of mud. This was the case in 1806 when a huge mass of the Rossberg, over one mile long, 1,000 feet wide and 100 feet thick, slid down from a height of 3,000 feet into the narrow valley, overwhelming with mud and the rocky chaos of superincumbent conglomerate four villages and 457 of their inhabitants, and filling up one-fourth part of Lake Lowerz. The scarred side of the Rossberg still indicates the path and extent of this great land-slide and the Luzerne — St. Gothard railway now passes over the wreck with its huge piles of rock and stagnant pools of water between. The Zug accident was undoubtedly the result of a similar sequence of geological events, the formation being identical, we understand. — *Engineering News.*

Electrical Motors for Cars. — Experiments recently made with electric-motors show encouraging progress in the art of applying electric force to street railways, and it now seems probable that within a few years this force will be substituted for horse-power on hundreds of miles of road. The managers and owners of street railways are manifesting great interest in the tests to which the new motors are being subjected. The rejection of horse-power to make way for electricity upon the street railways of our large cities appears, remarks the *New York Times,* to await now upon the successful development of certain methods of applying the force and a demonstration that running expenses can be reduced by the change. The recent tests of the storage-battery motors in this city seem to point to the ultimate selection of such motors for use in crowded streets. Last week an ordinary car moved by a storage-battery passed repeatedly over the Fourth Avenue surface road. At times the speed was twelve and even fifteen miles an hour. The car was easily controlled. The speed was governed without the slightest difficulty, and stops were made with greater precision than is attained when horses are used. It is stated that a car moved by such a motor can be used at a cost of $4.10 a day, while the cost of the same amount of service with horses is $7.50. If this be true, no objection on the score of expense can be urged.

Many will be surprised by the statement that more than 3,500,000 passengers are carried annually in this country on street cars moved by electric-motors. In Montgomery, Ala., electricity is used on eleven miles of road, and the cost is reported by the general manager to be only one-half the cost of horse-power. Roads on which electricity takes the place of horses are found in Baltimore, Los Angeles, Port Huron, Detroit, Scranton, Appleton, Wis., and Denver. Electric railways are either in course of construction or under contract in twelve other cities, and in thirty-seven companies have been formed, or other steps taken for the building of such roads. Upon none of the roads now in operation in this country, however, is force supplied by storage-batteries attached to the cars. In most cases power is communicated by an overhead conductor. More than 3,000,000 passengers are carried every year by electric railways in Europe. The Frankfort-Offenbach line has four miles of double track, uses fourteen motor cars, and carries 990,000 passengers. The power is communicated by overhead slotted tubes. But the roads in Brussels and Hamburg are operated by storage-batteries upon the system tested last week in this city.

The system of independent motors attached to cars is clearly to be preferred, if it will do the work that is done by the more cumbrous systems, and do it at no greater cost. The storage-batteries can be placed under the seats of a car. They are so arranged that the amount of force used can be quickly reduced or increased by the driver. Each car is independent of all others, and its movements do not depend upon the transmission of force from a stationary centre of generation. A car using an independent and detached motor must be more serviceable under certain adverse conditions than one to which force is transmitted. Therefore, the successful development of this system is greatly to be desired.

Street cars operated by independent electric-motors that are easily controlled and capable of carrying passengers at the rate of twelve or fifteen miles an hour are greatly to be preferred to cars moved by a cable. The whole line may be blocked on a cable road by the failure of the cable or by any accident that checks its steady movement. The cable system is not fitted for use in the narrow and crowded streets of a city like this, but cars moved by storage-batteries would probably meet all the varying conditions even more successfully than cars moved by horse-power. The advantages to be gained by the substitution of independent electric motors for horses in New York are many and important. The greatest of them would be the removal of thousands of horses from the streets, the abolition of the enormous stables whose accumulations poison the air, and the abatement of dangerous nuisances caused by the storage and transportation of manure that has been taken from the stables. Citizens will rejoice if the companies shall decide that the change can be made. — *Electrical Review.*

TRADE SURVEYS

All of the trade indications point to an enlarging demand for all kinds of raw material and manufactured products. The agricultural interests are in a thriving condition, although there is, or will be, a deficit of ten per cent in the wheat crop — which will be partially compensated for by an increased corn crop. A heavy cotton crop is assured, and a very heavy demand for the product will help to maintain prices at a point which will encourage the extension of the cotton area. The wool clip will not be behind former years; but at present, prices are not so strong, because of the dulness in products, which, however, may be shortly corrected. Our export trade is in excellent shape, and for the four principal products — breadstuffs, provisions, cotton, and petroleum, the ratio for the past season as against the previous season was as fifty to forty-six. The reports from one hundred and thirteen railroad companies for June show an increase of over $3,000,000, and for six months the increase on one hundred and eleven railroads is equal to seventeen per cent against the same six months last year. Demand for all kinds of machinery and motive-power continues to increase. The larger establishments in the New England and Middle States have, within the past ten days, booked some of the largest orders of the season. The large industrial establishments projected in the South are also being heard from in the way of orders for all kinds of enormous and costly equipment. Investors are putting in the best, regardless of cost, and in this respect are gaining economic advantages. Some observers in the Southern States, incline to the belief that the investments there are going too far; but this is a mere opinion. This is an exceptional era, and it is mere guess-work to say whether the extraordinary activity is wise or not. The investments may not yield the anticipated returns for a year or two, possibly; but that fact is immaterial to the general public. The capital is better invested and employed, even at narrow margins, than it would be remaining unemployed, and perhaps diverted into speculative channels. The upward tendency which is manifesting itself in several industries, is helping to steady demand. Consumers do not believe that higher, or even high prices can be maintained without enormous productive capacity, and in this they are, no doubt, right; and sooner or later a downward tendency will be developed. Five months ago steel-rail makers expected to sell rails at this time at $42.50 at mill; but large orders have been taken within a week at $5 per ton less, to keep out foreign rails. Bars and plates have advanced slightly, and special brands of pig-iron have also improved. Old rails have advanced to extreme prices and will decline as soon as foreign supplies can be received.

The lumber trade is very active in spite of the season. The possibility of an advance later on has led to the shipment of large quantities of white pine to the East. Yellow pine has been received in large quantities, and the entire lumber situation is exceptionally strong. The railroad and building demand is extremely heavy. The statistics furnished at different points show that building activity is still surpassing its best previous records. Even throughout the East much more building is being done than last year, and permits for new work are being taken out for fall work. Matters are shaping themselves right in Chicago, and in the far Northwest building operations are being pushed as fast as material can be supplied. In the Ohio Valley a great deal of new work has been projected within a month, which seems to be the reflected light of activity in the Southern States. A great many little industries are springing up near the sources of coal supplies, and cheap lumber. In a great many localities in the Ohio Valley land has improved in value, and house-building is following in the wake. Architects in Cincinnati and Louisville say that the indications are very favorable for greater activity in this direction than heretofore. The working classes have put up with indifferent accommodations, and a spirit of enterprise, it seems, has now taken possession of them, which has been stimulated by the formation of building associations in some localities. Taking the West all through, the evidences are not wanting of an improving condition of trade and industry. The mines have been worked better this year; the foundries have been busier; the agricultural-implement works have had very little idle time, and all those industries connected with the cultivation of the soil have been improving steadily since the opening of the year. The satisfactory conditions throughout the States on this side of the Mississippi appear to be checking the outflow of population which showed itself last year. And there is more contentment among the wealth-producers of those States.

The boat-yards along the lakes, the furniture-manufacturers throughout the West, the tool and implement makers both East and West, and the car-builders have all had an unusual amount of business placed before them, and the order-books of these concerns are better filled than they have been for many years. This active industrial condition throughout the West is exhibiting results in the accumulation of orders farther East. In the New England States a large amount of work has been taken for the West in electrical appliances, in paper contracts, in cotton and leather goods, and, in fact, in all the products of Eastern factories and mills. Factory capacity is not being increased as fast as it would have been under other circumstances. In the New England States new mills are being built, and old ones extended, but there is a cautiousness which shows that trade requirements are very closely studied. It is only among the iron and steel makers that there are many appearances of rash expansion; these interests may be right in pushing work as fast as they are, and they justify their course by pointing to the importations of 100,000 tons of foreign iron and steel per month. The possibility of an industrial disaster, in view of all these facts and conditions, is remote; but wise men are watching the course of things with the greatest care. If we take out the factor of railroad construction at the rate of 10,000 miles per year, it is easy to see the results that would follow. There are more probabilities of an increase in railroad construction beyond that limit than a falling below it. Yet, after all, the purchasing-power of the masses must be preserved. Other problems have to be studied and solved, than those involving the greatest possible production of a given capacity. The prosperity of the country depends upon something more than making numerous wheels, and turning them rapidly. The distribution of wealth must gradually approach an equitable basis, however that is to be accomplished.

THE AMERICAN ARCHITECT AND BUILDING NEWS.

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CONTENTS

THE Secretary of the Treasury has just appointed Mr. W. A. Freret, of New Orleans, to be Supervising Architect of the Treasury Department, in place of Mr. Melville E. Bell, who resigned his position some time ago, but has remained in charge of the office, pending the appointment of a successor, until now. Mr. Freret is an experienced architect, in the prime of life, and with a reputation for energy and professional enthusiasm quite exceptional in the South. Mr. Freret's training was of the best that his time and State afforded, his *patron* having been a graduate of the Polytechnic School in Paris; and he has since practised his profession with much credit and success. While it is impossible not to regret that the highest and most responsible professional office in the gift of the Government should be endowed with so poor a salary as that attached to the appointment of Supervising Architect, we will remind Mr. Freret, by way of consolation, that even a few years' administration of it will give him a permanent place in architectural history. When the history of the architecture of this country comes to be written, as it surely will sooner or later, the materials for the work will of necessity be almost entirely derived from the buildings which at that period shall be most conspicuous and best preserved. A century hence the structures erected by the Government since the Civil War will fulfil that description much better than any others, and the sequence of architectural styles in this country will be studied mainly in them; while, independent of their importance in this respect, the public archives, which will show the details of their erection, must furnish the most available literary material for the work, so that, to the future historian of American art, the succession of the Government Architects will be nearly as important as that of the kings of England in British secular history. If we could now anticipate the disquisitions of the Fergussons and Freemans of the year 2000, we should probably be amused to see their chapters headed "The Mullett Era," "The Bell Style," or "The Freret Transition," but the tendency of all history is to select conspicuous figures, and attribute mainly to them the movements in which scores of others participated in a nearly equal degree; and the men whose names occur most frequently in public documents, and whose work has cost the most and endured the longest, are pretty sure to gain a more and more important place in the annals of art as time goes by.

THE *IRON AGE* gives a method which architects may find of value, for determining, roughly, the evenness of casting of iron pipes. Two planks are laid on the floor or ground, parallel to each other, and about two feet apart. One end of each plank is raised on a brick, or something of the kind, so as to form a sort of inclined track. The lengths of pipe to be tested are then placed one by one on the upper end of the planks, and allowed to roll down. If the planks are straight, and the ends even, the good pipes will roll straight down; but the pipes which are unequally cast, or in which the core has risen, so as to make the metal in the middle thick on one side and thin on the other, will roll irregularly, and, unless the irregularity of metal should happen to be put in the middle, will show a disposition to run off the track, which, as the *Iron Age* says, should be encouraged until they have departed, never to return. There is nothing more annoying to architects than the carelessness with which iron soil and waste pipes are cast, particularly the double-thick pipes, which, instead of being greatly superior to the single-thick, as they would be if their quality could be relied upon, are often actually inferior to the cheaper ones, on account of the inequality of thickness produced by variations in the position of the core. We have seen the metal in a broken double-thick pipe, which ought to be one-quarter of an inch thick all around, nearly as thin as a sheet of paper on one side, and almost half an inch thick on the other; and as such defects generally occur near the middle of the lengths of pipe, instead of at the ends, most architects have found it impracticable to detect them without breaking the pipe, and many of them have been driven, in consequence, to the adoption of the Durham pipes, the quality of which can be relied upon. The method of the *Iron Age* seems likely to offer just the simple test which architects need, and we hope it will be applied by them vigorously, until the bad pipe, which disgraces some manufacturers whose reputation has led architects to place in them a confidence which they do not deserve, is driven from the market. If some one of our own readers will supplement this method by an easy means of ascertaining the weight, or, rather, the thickness, of lead pipe after it is placed in position, he would render a service to the profession and the public. We have seen a building plumbed with lead-pipe so thin that a rather moderate effort to turn the lever of a ground-cock which moved with difficulty resulted in pulling off the pipe to which it was attached; but we have never yet found a plumber who knew how to tell with certainty the thickness of pipes in position. Something may be judged by the appearance of the bends. A thin pipe is apt to be buckled or flattened at the turns, choking the bore somewhat; but this can be avoided, if the plumber is not afraid of tearing the thin metal asunder by the stretching at the outer side of the curve, by filling the pipe with sand before bending it. With very thin pipe an indentation can be made by pressure, but this would be difficult with small pipe, with metal one-eighth of an inch thick or so, and the most important point in practice is to distinguish between this and pipe with walls three-sixteenths or one-quarter of an inch thick.

ONE of the most noteworthy occurrences in matters of art of the last month is the engagement of Mr. Mercié, the great French sculptor, to execute the statue of General Lee to be erected at Richmond. We are sorry not to have more minute details of the affair than are to be found in the daily papers; but it appears that there was some sort of competition, and that a local artist, who imagined that he had the "inside track," suffered a severe disappointment by the decision. It is a little remarkable that a city in the South, where personal and family connections, and local exclusiveness, flourish in an extraordinary degree, should have been almost the first in the country to set the example of trying to get the best sculpture to be had in the world, without regard to the sculptor's grandparents, or the place where he lived, and to administer a signal rebuke to the system of introductions, button-holing, wire-pulling and influence which does so much to make our pretended artistic competitions contemptible, and the result of them ridiculous. We are not at all disposed to underrate our own artists; on the contrary, we are quite as proud of Mr. Ball's "Washington," Mr. St. Gaudens's "Farragut," and some of Mr. Warner's beautiful work, as any Parisian could be of French sculpture; but when we think how rare such works as these are, instead of being, as they might and ought to be, familiar sights in every town in the country; and how many millions of dollars, with which a great school of American sculpture might have been developed, and our cities nobly adorned, have been spent on grotesque caricatures of statues and bas-reliefs, we cannot help welcoming the indication of a wish on the part of a public body to secure something in the way of sculpture that those who have seen good statues need not be ashamed of. Hitherto, in this country, if artists could work with their tongue, or their dimples, it has not been necessary for them to possess much skill with their hands to be employed on the most distinguished public commissions; and the result of the system is to be seen in the ludicrous collection of paintings and statuary exhibited in the Government buildings

at Washington. We hope some time to see that rubbish thrown away, to make room for work, such as some Americans are capable of, as far superior to it as, let us say, the *Merchant of Venice* is to a dime novel; but, as long as these things, or a large part of the soldiers' monuments of the country, remain in their places of honor, just so long will the public taste be deceived and perverted, and the genius of those who might reflect glory on their native land by their beautiful works, be fatally discouraged and led astray.

WE often get letters in regard to stains on bronze statues, and imagine that many persons will like to make a mental note of the suggestions for cleaning them from the ordinary discolorations, which the editor of *Le Génie Civil* collects from *La Nature*, the *Bulletin* of the Chemical Society of Paris, and Dingler's *Polytechnische Journal.* According to these, the first effect of the atmosphere upon bronze is to cover it with a green patina, composed of a mixture of hydrates and carbonates of copper. When organic dust, including, we might perhaps say, the drip from trees, which is generally highly charged with organic matter, falls upon the patina, it soon begins to decompose and absorb oxygen from the copper salts, reducing them, where the action is most marked, to oxides, or even to metallic copper, in a state of fine division. Either the oxide or the metal, when finely divided, is black, and the bright green patina begins to be discolored with black spots. As the surface loses its polish, it retains more dust, and the action increases until the bronze is covered with a tolerably thick black crust consisting of copper, with oxides and sulphides, mixed with powdered silica from the pavements, and various compounds of ammonia and phosphorus, representing the complete decomposition of animal and vegetable substances. Whether the composition of the bronze has any influence in the formation of the crust so that, as has been asserted, a bronze containing no zinc is not liable to black discoloration, seems to be doubtful, and there is still need of experiments upon this point; but it is satisfactory to know that the black, after it has formed, may be removed without injury to the bronze by washing the statue or other object with a solution of cyanide of potassium in water. This solution, which, by the way, is terribly poisonous, sometimes causing fainting by mere contact with a scratch on the skin, dissolves the black compounds of copper without affecting the metal underneath. Whether the cyanide attacks the green patina we are not informed, but if it should do so, the color is said to be soon restored by oiling the surface of the bronze. The same article contains a direction for cleaning marble statues by washing them with water which has stood for some time over fragments of marble, which is also worth remembering. All natural waters contain carbonic acid, which attacks the surface of a marble statue washed with them unless it has been previously saturated with the limestone by soaking pieces in it.

A VERY remarkable discovery has recently been made at Civita Castellana, about forty miles from Rome. The modern village stands nearly on the site of the great Etruscan city of Falerii, and the neighboring ravines are full of Etruscan tombs hewn in the rock, so that the place has always had considerable attraction for the archæologist. Within a few weeks, as we learn from the *Deutsche Bauzeitung*, which credits its information to a letter in one of the daily papers of Cologne, a new attempt has been made to study the locality. About two miles from the present village is a particularly populous necropolis, in the middle of which is a deep valley, drained by a brook, and it occurred to some investigator to make excavations in this valley. One would hardly expect to find important buildings in such a situation, and the idea of excavating there seems to have been a mere guess, but it was a fortunate one, for the work soon brought to light the remains, in excellent preservation, of an Etruscan temple, the only one which has yet been discovered. We have several descriptions of the Etruscan buildings in Vitruvius and other ancient writers, and know something of their appearance, but they were built mostly of wood, and have perished so completely that no trace of them remains above ground to guide the explorer. The investigators at Falerii happened to dig in exactly the right spot, for although they, of course, found no woodwork of the temple which once stood there, they discovered the foundation-walls, the mosaic pavements, the pedestal on which stood the statue of the deity, and portions of the statue itself, besides many of the terra-cotta plates with which the ceiling and walls were ornamented. The building stood in the valley, under the shadow of a rocky cliff, directly against which it seems to have been constructed. A platform of cut stone, put together without mortar, formed the stylobate, and on this were found the remains of a rear wall, one hundred and forty feet long, built, apparently, parallel with the cliff, but at a little distance from it, so as to allow a passage between the wall and the rock. This rear wall was ten feet thick, and four partition-walls, each six feet thick, projected forward from it, dividing the building into three parallel cellæ, exactly like the nave and aisles of a church, except that solid walls took the place of the nave arcade or colonnade. This is known from the ancient writers to have been the usual disposition of the Etruscan temples, but an unexpected variation from the descriptions was found in the shape of a sort of chancel, or quadrangular apse, formed by extending the central cella about twenty-six feet beyond the main rear wall, and raising the pavement of the extension above that of the rest of the building. If we could suppose the partition-walls between the middle and side cellæ to be replaced by columns, this disposition would, without further change, be substantially that of a modern church, or its prototype, the basilica, and as only the lower portions of the walls were found in place, we need not, perhaps, do much violence to probability by imagining that openings may have been left in the division-walls, through which persons in the aisles or side-rooms could see something of what went on in the nave. The evident attempt to give dignity to the chancel, both by extending it and raising its floor, indicates that this was the most important point of the building, and, indeed, the pedestal of the statue of the deity, with its stylobate, was found in the centre of the entrance of the apse, with the fragments of the statue which it once bore still lying upon it. Just behind the pedestal of the statue was a pit in the floor, partly filled with votive offerings, and attached to the rear wall of the apse was a basin, into which spring-water from the mountain was brought by a conduit through the wall. The part which these accessories played in the Etruscan worship it would be impossible to conjecture, but it is hardly credible that the side cellæ should have been altogether cut off from the sight of the ceremonies, which, to all appearance, were confined exclusively to the central one.

THAT the building had a peristyle or exterior colonnades of some kind seems probable, but not certain. We learn from the Roman writers that the pillars of the Etruscan temples were usually of wood, and no trace of them remained, but the extension of the platform and the rear wall far beyond the side walls certainly indicated that something of the sort once occupied the space, and this impression was confirmed by the remains of antæ at the corners. That a portico covered the front was shown by the terra-cotta ornaments of the tympanum over it, which were found in the place where they fell when the woodwork rotted away. Supposing the side colonnades to have stood on a line with the extremities of the rear wall, the complete temple was one hundred and forty feet wide, by one hundred and sixty-three feet deep, and must have been a very imposing structure. The floor was covered with a mosaic pavement, of geometrical pieces of red, white and black terra-cotta, and the walls were lined with plates of whitish terra-cotta, about an inch and a half thick, painted in white and red on a black ground, with huge figures of men, divided by conventional palms, so that each figure had a compartment to itself. A frieze and cornice of terra-cotta seem to have finished the walls at the top, and many pieces of these were found pierced with holes for nailing them to the woodwork which, apparently, formed the upper portion of the construction. The roof was evidently of wood, covered with tiles of the same whitish terra-cotta as the plates on the walls, and the pediment group of statues in terra-cotta, but of beautiful design, was found.

THESE statues were apparently of late workmanship, dating from the time of the Romans, and may, very probably, have replaced older ones after the temple had begun to stand in need of restoration. The frescos on the wall were entirely Etruscan, resembling the paintings on the walls of the tombs at Tarquinii and Orvieto, and the head of the statue of the deity, which was the only part so far recovered, was of the same archaic style, with almond-shaped eyes and low forehead, although it was decorated with a beautiful laurel-wreath of bronze, fragments of which were found near, and the ears were bored for rings, as if the statue had once been adorned with the jewelry of which the Etruscans were so fond.

THE CRUSHING STRENGTH OF BRICK PIERS, — I.

AND THE STRENGTH OF SINGLE BRICKS AND MORTARS USED IN THEIR CONSTRUCTION.



THE report of tests made with the U. S. testing-machine at the Watertown Arsenal for the year 1884, a congressional document, recently published, contains the results of a valuable series of tests on the strength and compressibility of brick piers. Three kinds of brick were represented in the construction of the piers, and mortars of different composition ranging in strength from lime mortar to neat Portland cement. The piers ranged in cross-section dimensions from 8″ x 8″ to 16″ x 16″, and in height from 16″ to 10′.

THE TESTS OF THE SINGLE BRICKS.

There were used common and face bricks, both hard-burnt, from the yard of M. W. Sands, North Cambridge, Mass., and a softer common brick from the Bay State Company. The Bay State brick, previous to being used in the piers, had been in the supporting-walls of an experimental floor and the arches thereof, but none were used which showed evidence of injury done by the previous loading. The bricks were prepared for testing by grinding their bed-surfaces approximately flat with loose emery on a face-plate and packing with thin sheet-brass those places which did not come to a full bearing against the compression platforms or buttresses of the testing-machine.

In the subsequent tests of the mortars and the piers a thin facing of plaster-of-Paris was employed to secure an even distribution of the loads.

When the bricks were adjusted in position for testing, the loads were gradually applied and increased till the maximum was reached which the material was capable of sustaining. This maximum load is recorded as the ultimate strength of the specimen tested.

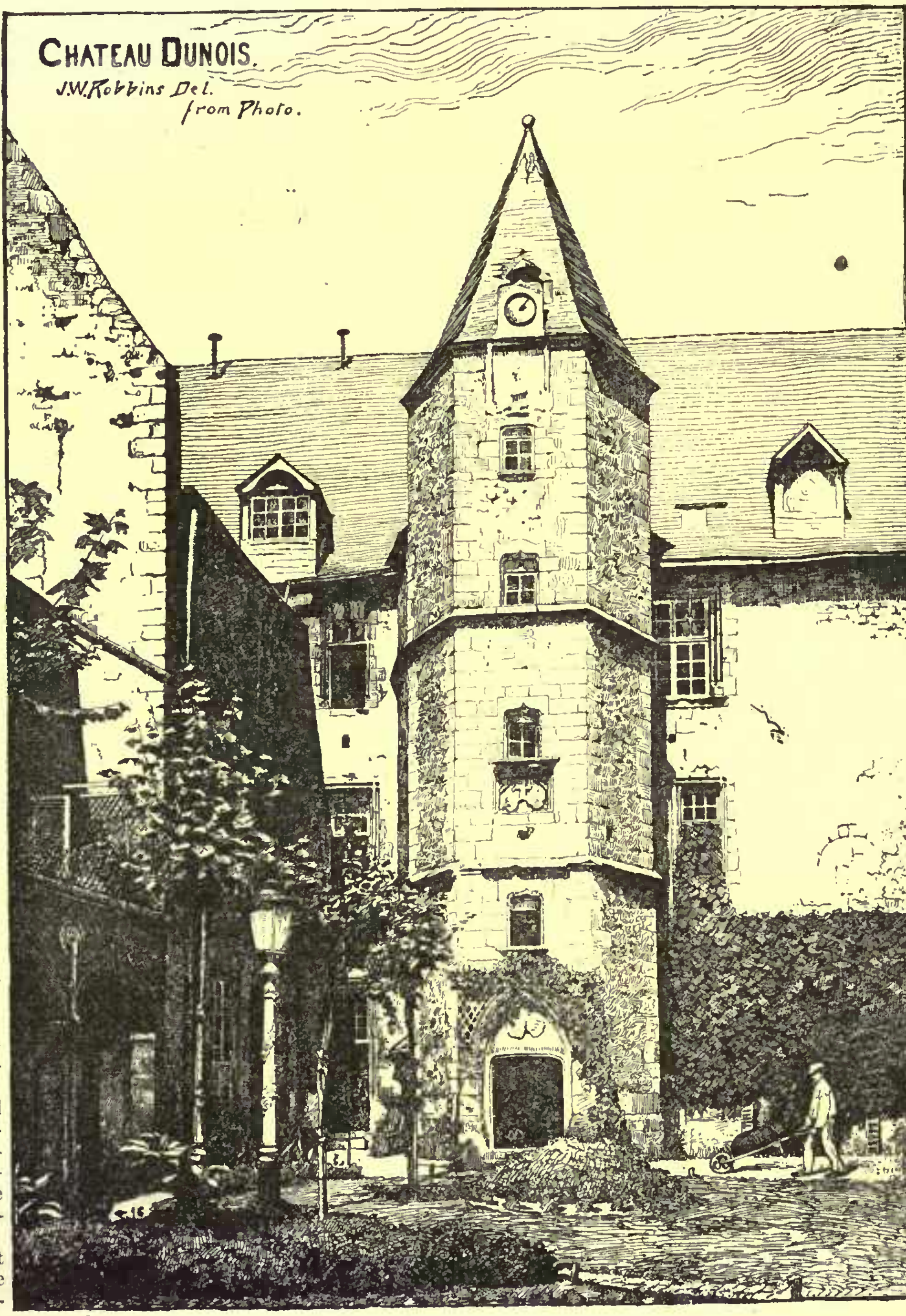
Owing to the want of uniformity in the strength of the material or the imperfect distribution of loads, cracks appear in the bricks some time before the maximum loads are reached, and failures occur more or less in detail. Such fractures indicate the development of less strength than belong to certain parts of the material, but on the other hand, contact of the bed-surfaces of the bricks with the rigid platforms of the testing-machine tends to increase their apparent strength by supporting the bricks in the direction normal to the line of pressure. It is probably on account of the influence of the rigid platforms between which the single bricks were crushed that their strength when thus tested so greatly exceeded the strength of the piers.

Generally speaking, we should expect the strongest single bricks to make the strongest piers, and this result would doubtless follow when the conditions were equable. The fact that the tests do not show the same order of strength maintained in the piers and single bricks is attributed to the better distribution of loads relatively in one case over the other, and emphasizes what is conspicuous in all tests of masonry, namely, that the loads should be evenly distributed.

The mean strength of three single bricks of a kind, which were selected as fairly representing their class, was taken as a basis for comparing the different piers, and computing their efficiencies.

Unusual strength is displayed by the strongest of the above samples. Within limits, the crushing strength of bricks increases with the degree of hardness to which they have been burnt, and those bricks which gave very high results were very hard burnt. Opportunity has not yet offered for testing the same clay burnt to different degrees of hardness up to the point of vitrification, and thus ascertaining the maximum and minimum values of the same material.

Observations made on various kinds of bricks, however, have shown that the greatest strength was not found in those of extreme hardness, but to what extent the results were influenced by the irregular shapes of these very hard bricks, and the consequent uneven distribution of loads when tested, it is difficult to reach a decision.



The tests now referred to were made upon bricks which were not ground flat on their bed-surfaces, but they were carefully faced with plaster-of-Paris.

While plaster has given the best results of any facing or cushion yet tried, it is evident that the distribution of load will not be perfect when the thickness of facing varies to accommodate an uneven surface, unless the material of the facing and the specimen possess the same compressibility, a condition seldom fulfilled, although we may reach a close approximation at times.

TESTS OF THE MORTAR.

Three six-inch cubes of each kind of mortar used in the piers were made, and after seasoning in the air a period of fourteen and a half months were tested. The age of the plaster cube was four months. They were tested in the same manner as the single bricks; that is, between the flat steel platforms of the testing-machine. The compressibility of the cubes is shown by the micrometer readings taken from face to face of the platforms. When the dimensions of the specimens admit, micrometer observations are made wholly on the specimens themselves, using a gauged length somewhat less than the length of the specimen.

The results show the lime-mortar to have a very low crushing strength. It is evidently not the mortar to employ when strong work is required, neither should it be used in very wide or thick joints. It may be said that practically the lime assists in holding in place sand cushions between the bricks, and that is about all it probably does.

The Portland cement heads the list as regards strength, greatly

exceeding in this respect the kind of Rosendale cement used. The admixture of sand with these cements in the proportions of two to one reduced the strength of the Portland cement eighty-four per cent

TABULATED RESULTS.

Description.	Dimensions. Length.	Width.	Thickness.	Comp's'd area.	First crack.	Ultimate strength. Total.	Per sq. in.
	In.	In.	In.	Sq. inch.	Pounds.	Pounds.	Pounds.
	7.75	3.70	2.10	28.68	174,000	317,100	11,056
M. W. Sands's face bricks.	7.75	3.76	2.07	29.14	175,000	407,500	13,984
	7.52	3.57	2.05	26.85	110,000	449,300	16,734
				Mean	crushing	strength,	13,925
	8.12	3.50	2.07	28.42	445,000	562,300	19,785
M. W. Sands's common bricks.	7.90	3.56	2.15	28.12	312,000	628,500	22,351
	8.10	3.62	2.12	29.32	95,000	381,000	12,995
				Mean	crushing	strength,	18,337
	7.90	3.57	2.06	28.20	145,000	313,600	11,120
Bay State bricks (old)........	7.78	3.70	2.02	28.79	215,000	365,900	12,709
	7.70	3.50	2.11	26.95	196,000	280,000	10,390
				Mean	crushing	strength,	11,406

and of the Rosendale cement sixty-nine per cent, the average crushing strength of the two mortars now being: Portland cement mortar,

TABULATED RESULTS, 6″ MORTAR CUBES.

CRUSHING STRENGTH.

No. of test.	Composition.	First crack.	Ultimate strength ℔ sq. in.	Weight per cu. ft.
		lbs.	lbs.	lbs.
3 *a*	1 part lime, 3 parts sand,		135	112
3 *b*	" " " "		119	111
3 *c*	" " " "		118	106
4 *a*	1 part Portland cement, 2 parts sand,		560	116
4 *b*	" " " "		696	120
4 *c*	" " " "	11,500	383	115
5 *a*	1 part Rosendale cement, 2 parts sand,		156	111
5 *b*	" " " "		186	109
5 *c*	" " " "	4,500	143	107
6 *a*	Neat Portland cement,		2,673	126
6 *b*	" "	95,000	3,548	129
6 *c*	" "		4,227	135
7 *a*	Neat Rosendale cement,	11,000	421	94
7 *b*	" "	19,000	615	99
7 *c*	" "	19,200	526	97
8 *a*	1 part Portland cement, 2 parts lime-mortar.[1]		204	109
8 *b*	" " " "		198	110
8 *c*	" " " "		175	103
9 *a*	1 part Rosendale cement, 2 parts lime-mortar.[1]		194	105
9 *b*	" " " "		193	106
9 *c*	" " " "		162	105
	Plaster-of-Paris,		1,981	74

[1] Lime-mortar, 1 part lime, 3 parts sand.

five hundred and forty-six pounds per square inch; Rosendale cement mortar, one hundred and sixty-two pounds per square inch.

The Rosendale cement mixed with lime mortar showed practically the same strength, as when mixed with two parts sand, the difference happening to be in favor of the mortar containing the lime.

TABULATED RESULTS, 6″ MORTAR CUBES, COMPRESSIBILITY UNDER STRESS.

No. of Test.	Compression under loads in pounds of — 500[1]	1,000	2,000	3,000	4,000	5,000	6,000	8,000	10,000	20,000
	In.	In.	In.	In.	In.	In.	In.	In.	In.	In.
3 *a*	0	.0014	.0056	.0124	.0194					
3 *b*	0	.0005	.0160	.0310						
3 *c*	0	.0020	.0080	.0146	.0450					
4 *a*	0	.0010	.0025	.0038	.0050	.0060	.0070	.0085	.0103	.0310
4 *c*	0	.0010	.0022	.0030	.0050	.0065	.0080	.0120	.0170	
5 *a*	0	.0020	.0040	.0060	.0090	.0160				
5 *b*	0	.0015	.0040	.0062	.0090	.0130				
5 *c*	0	.0040	.0100	.0170	.0235	.0395				
6 *b*	0	——	.0010	.0020	.0030	.0035	.0040	.0048	.0052	.0054
6 *c*	0	.0008	.0012	.0018	.0023	.0030	.0035	.0045	.0052	.0082
7 *a*	0	.0010	.0018	.0025	.0035	.0040	.0045	.0050	.0070	
7 *b*	0	.0010	.0020	.0035	.0050	.0065	.0078	.0100	.0120	.0260
7 *c*	0	.0018	.0055	.0090	.0110	.0135	.0155	.0200	.0245	
8 *a*	0	.0005	.0020	.0035	.0050	.0070	.0090			
8 *b*	0	.0015	.0048	.0075	.0092	.0120	.0160			
8 *c*	0	.0030	.0105	.0180	.0270	.0370	.0480			
9 *a*	0	.0010	.0045	.0090	.0150	.0220	.0290			
9 *b*	0	.0005	.0018	.0030	.0045	.0075	.0130			
9 *c*	0	.0005	.0020	.0045	.0070	.0120				
Plaster-of-Paris.	0	.0002	.0008	.0018	.0024	.0030	.0038	.0048	.0058	.0102

[1] Initial load.

Quite a different state of affairs is found when lime-mortar is added to the Portland cement, the strength of the mortar being reduced to one hundred and ninety-two pounds per square inch. Hence there is very little difference in the resulting mortar whether this or the Rosendale cement is used with the lime. This is a very important point, and should be confirmed by further experiments in order to definitely establish the relative deleterious influence of the admixture of lime with different cements.

The compressibility of the cubes under stress follow approximately

No. of tests.	Compression under loads in pounds of — 40,000	60,000	80,000	100,000	120,000	140,000
	In.	In.	In.	In.	In.	In.
6 *b*	.0066	.0090	.0120	.0170		
6 *c*	.0125	.0160	.0200	.0235	.0290	.0360
Plaster-of-Paris.	.0175	.0281				

their crushing strength, the strongest cubes being also the stiffest, although much irregularity exists among cubes of the same composition. Plaster-of-Paris is found the second in strength and in stiffness, yet by far the lightest in weight.

We should expect from an examination of these results that great inequality in behavior would be found in different piers laid up with different kinds of mortars, their compressibility, in a measure, conforming to the behavior exhibited by the mortar cubes. Such, in fact,

TABULATED RESULTS.—CRUSHING STRENGTH OF BRICK PIERS.

BUILT OF FACE-BRICKS (M. W. SANDS).

No. of Test.	Nominal dimensions. Height. Ft.	Height. In.	Cross-section In.	Cross-section In.	Composition of Mortar.	Weight per cu. ft.	Actual dimensions. Height. Ft.	Height. In.	Cross-section. In.	Cross-section. In.	Sectional area.	First crack.	Ultimate strength. Total.	℔ sq. in.	℔ sq. ft.	% of single brick.
	Ft.	In.	In.	In.		Pounds.	Ft.	In.	In.	In.	Sq. in.	lbs.	lbs.	lbs.	Tons.	
11	1	4	8	8	1 lime, 3 sand,	137.4	1	4.13	7.55	7.55	57.00	85,000	143,600	2,520	181.4	18.1
320	6	8	8	8	" "	133.5	6	8.00	7.60	7.60	57.76	50,000	108,400	1,877	135.1	13.5
12	1	4	8	8	1 Portland cement, 2 sand,	136.3	1	4.24	7.60	7.60	57.76	200,000	218,100	3,776	271.8	27.1
321	6	8	8	8	" " "	133.5	6	8.00	7.60	7.60	57.76	85,000	129,900	2,249	161.9	16.2
283	2	0	12	12	1 lime, 3 sand,		1	11.05	11.50	11.50	132.25	140,000	257,100	1,940	139.7	13.9
284[1]	2	0	12	12	" "		1	11.04	11.50	11.50	113.76	90,000	226,100	1,990	143.3	14.3
332	10	0	12	12	" "	131.7	9	11.90	11.50	11.50	132.25	70,000	199,800	1,511	108.8	10.9
334[2]	10	0	12	12	" "	125.0	9	11.13	11.50	11.50	115.44	100,000	208,600	1,807	130,1	13.0
286	2	0	12	12	1 Portland cement, 2 sand,		1	11.50	11.50	11.50	132.25	200,000	486,000	3,670	264.2	26.4
326	10	0	12	12	" " "	132.2	9	11.30	11.50	11.50	132.25	200,000	298,000	2,253	162.2	16.2
					BUILT OF COMMON BRICKS (M. W. SANDS).											
10	1	4	8	8	1 lime, 3 sand,	135.6	1	4.48	7.8	7.8	60.80	66,000	148,800	2,440	175.6	13.3
12½	6	8	8	8	" "	133.6	6	8.05	7.9	7.9	62.40		96,100	1,540	110.8	8.4
281	2	0	12	12	" "		1	11.90	11.75	11.75	138.06	75,000	296,400	2,150	154.8	11.7
282[3]	2	0	12	12	" "		2	0.30	11.75	11.90	119.58	120,000	244,600	2,050	147.6	11.2
331	9	9	12	12	" "	131.5	9	9.60	11.75	11.75	138.06	70,000	154,300	1,118	80.5	6.1
330[4]	10	0	12	12	" "	136.0	10	0.40	11.75	11.75	115.50	70,000	183,300	1,587	114.3	8.6
329	10	0	12	12	1 Portland cement, 2 sand,	131.0	10	0.	11.75	11.75	138.06	190,000	276,600	2,003	144.2	10.9
387	2	8	16	16	" " "		2	7.85	16.00	16.00	256.00	460,000	696,000	2,720	195.8	14.8
328	10	0	16	16	" " "		10	1.00	16.00	16.00	256.00	340,000	483,100	1,887	135.8	10.3
					BUILT OF COMMON BRICKS (BAY STATE).											
285	2	0	12	12	1 lime, 3 sand,		2	0.10	12.10	12.10	146.41	95,000	201,000	1,370	98.6	12.0
288	6	0	12	12	" "		6	0.50	12.00	12.00	144.00	70,000	163,200	1,133	81.6	9.9
289	6	0	12	12	" "	119.7	6	1.00	12.00	12.00	144.00	100,000	174,300	1,210	87.1	10.6
291[5]	6	0	12	12	" "	118.2	6	0.25	12.00	12.00	144.00	80,000	191,600	1,331	95.8	11.7
292[6]	6	0	12	12	" "	118.1	6	1.00	12.50	12.50	156.25	110,000	189,200	1,211	87.2	10.6
325	7	10	12	12	" "	120.	7	10.25	12.00	12.00	144.00	100,000	169,100	1,174	84.6	10.3
327	10	0	12	12	" "	118.	9	11.60	12.00	12.00	144.00	90,000	133,100	924	66.6	8.1
335	10	0	8	12	" "	107.0	10	0.75	8.00	12.00	96.00	35,000	90,200	940	67.7	8.2
333	10	0	12	16	" "	118.7	10	0.50	12.00	16.00	192.00	80,000	148,500	773	55.7	6.8
301	6	0	12	12	1 Rosendale cement, 2 lime-mortar	120.6	6	1.63	12.00	12.00	144.00	160,000	237,000	1,646	118.5	14.4
293	6	0	12	12	" " 2 sand,	123.0	6	0.13	12.00	12.00	144.00	260,000	284,000	1,972	142.0	17.3
300	6	0	12	12	1 Portland cement, 2 lime-mortar,	120.3	6	1.33	12.00	12.00	144.00	150,000	203,200	1,411	101.6	12.4
294	6	0	12	12	" " 2 sand,	119.7	6	0.60	12.00	12.00	144.00	220,000	258,000	1,792	129.0	15.7
290	6	0	12	12	Neat Portland cement,	126.6	6	0.	12.00	12.00	144.00	280,000	342,000	2,375	171.0	20.8

[1] Has hollow core 4.25″ x 4.25″.
[2] Has hollow core 4.1 ″ x 4.1 ″.
[3] Has hollow core 4.5 ″ x 4.5 ″.
[4] Has hollow core 4.75″ x 4.75″.
[5] Joints broken every 6 courses.
[6] Bricks laid on edge.

was the case, and the quality of the mortar also exerted a striking influence on the strength of the piers. This will be referred to again when discussing the results obtained with the piers.

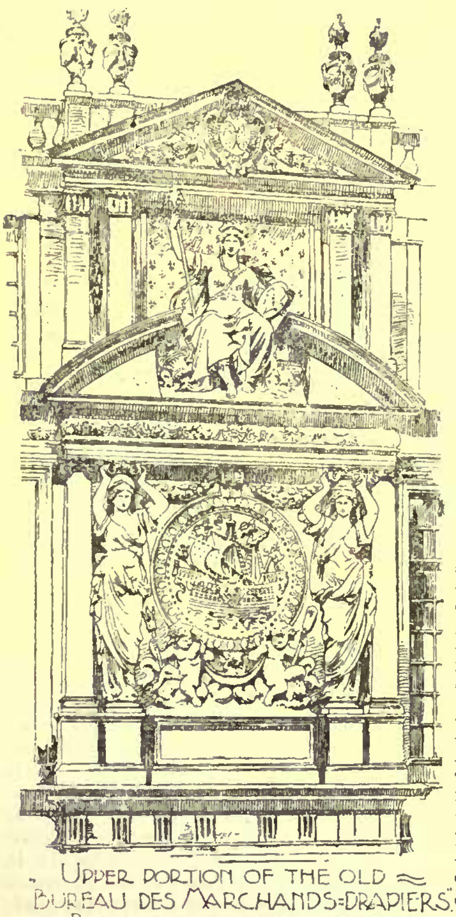
THE TESTS OF THE PIERS.

The piers were built and seasoned in a cool, dry building, and their ages when tested ranged from fourteen to twenty-four months. They were transported to the testing-machine and adjusted in the horizontal position in which they were tested in a fixture consisting of two end plates of cast-iron, set in plaster-of-Paris on the ends of the piers, and connected by rods provided with turn-buckles. By means of the side rods initial compression was given the enclosed pier, thereby increasing its transverse strength and enabling it to be handled without injury. When in readiness for testing, the tension of the side rods was released, the initial load of compression applied with the machine being sufficient to hold the pier in position. Micrometer observations were made on each pier within the gauged length, showing the compression of the piers for each increment of load above the initial, releasing the loads at intervals and determining the permanent sets — proceeding in this way until the ultimate strength was determined.

The gauged length was usually less than the height of the pier. This distance was laid off on the centre line of the upper face, as the pier lay in position for testing and symmetrical with the ends. Contact of the micrometer with the pier was made through the conical points of the micrometer which entered corresponding holes drilled in the bricks, these holes defining the limits of the gauged length. A weight placed over each micrometer point held the instrument firmly in position. JAMES E. HOWARD.

[To be continued.]

THE IMPORTANCE OF PRIVATE ARCHITECTURE.



UPPER PORTION OF THE OLD BUREAU DES MARCHANDS-DRAPIERS, PARIS. from THE BUILDER.

M. PAUL SÉDILLE has had the kindness to send us in advance of the publication of the proceedings of the recent Congress of the Société Centrale des Architectes the following extract from the report of the Jury intrusted with the decreeing of Awards to Private Architecture, Archæology, and Jurisprudence:

Monsieur, the Director of Fine Arts, Ladies, Gentlemen, and Fellow-workers— On the 13th of March, 1873, La Société Centrale des Architectes, gathered in general assembly, decided that each year it would award special recompenses to works of private architecture. In consequence of this decision, and by the unanimous vote of the jury then nominated, MM. Lesoufaché and Francois Rolland, architects, of Paris, and M. Claud Benoit, architect, of Lyons, received in 1874, in this same spot, the first medals of the Société Centrale. These medals had the effect of encouraging the institution of other recompenses, almost all of which, as our estimable secretary will tell you presently, are due to the generous initiative of the members of our society. Since the time of the respected names of Lesoufaché and Rolland, new names have been added each year to the already long list of our laureates in private architecture. These laureates you know, and their works sufficiently declare what is the character of the lofty recompense which is thus decreed in solemn session of our congress.

Nevertheless, allow me, gentlemen, to insist for a moment upon this point, and to recall to you here in a few words what has been the point of departure and what is the *raison d'etre* of the foundation which occupies us.

An ancient member of our society, already dead many years, but whose memory is sacredly dear to me (I am happy to recall to you here the name of Jules Sédille) was astonished at seeing in what isolated conditions architects often found themselves, who, not being in the employ of the State, or the municipalities, or the great administrations, were not charged with the construction, the restoration or the maintenance of our public monuments. The State seemed too little interested in them and their works, and reserved its distinctions and encouragements for those only who served it directly; and yet these architects were not only able practitioners and tried experts, but often, also, artists of worth beyond dispute. Full of faith in their art, they labored, often under trying conditions, to exact a respect for it from their co-laborers, as from those whose interests they served, by the conscientiousness which they brought to the study of the most modest works. Careful to satisfy the complex requirements of utilitarian programmes, searching always the logic of construction in view of a prudent distribution of forces and materials, they endeavored to prove that a building of honest and worthy appearance can still be an economical structure, less expensive than the products achieved at the reduced rates of outrageous speculation; and they sought consolation from the trials of their daily work in the constant search after art, and looked to their own consciences for the satisfaction due to effort made and duty accomplished.

Side by side with these artists militant, who maintain the traditions of our art in the midst of obscure labors and affairs, other architects, perhaps more favored, if not of higher worth, constructed important dwelling-places, sumptuous *hôtels*, elegant villas and superb chateaux. Then came the grand banking-houses, vast public hotels, the spacious edifices erected by commerce and industry, special monuments which seem to-day to embody all the progress of modern science as applied to construction. Why, then, have all these laborious architects, who do so much for the progress of our art, who maintain with firmness the ancient methods of good construction, at the same time that they are often the first to make a useful application of modern discoveries, why should not these architects have their just part of the rewards? And if they were worthy of recompenses, their fellows in the provinces were assuredly not less worthy.

What efforts must not our *confrères*, members of our affiliated societies, have made to erect, often far from the grand centres, with insufficient resources, with the imperfect materials of the localities, and with unskilled contractors and ignorant workmen, constructions worthy of the name. It is necessary there that the architect multiply himself, that he teach at the same time that he gives directions, and we can affirm that by his lessons and by his example he often accomplishes not only his work as an architect, but also the work of a good citizen, for he contributes to the elevating of the morals and to forming the intelligence of his assistants howsoever humble.

In taking this resolution to honor the works of private architecture the Society thought also that the construction of our public monuments may at certain times be limited either by occurrences or because present necessity has been satisfied. Then it is all-important that private architecture should be encouraged, so as to preserve sacredly the healthy traditions of the art of building, and that it endeavor to form the public taste by showing it that the useful can be brought into harmony with the worship of truth and with the love of the beautiful.

We know, besides, what an important place private architecture takes in the history of races. Chefs d'œuvre are everywhere; we search for them with ardor; we now defend their last remains with vigilance which is only equalled by the disdain not long ago professed for these same relics. We study with respect the slightest fragments of Greek, Tuscan or Roman cities; we air our admiration in Italy for the always-noble conceptions of the divine masters of the fifteenth century, who, even in their slightest work, always give testimony of a lively imagination allied to the purest taste; and, without going so far afield, about us in France, what charming remains of our old manor-houses, our old Middle-Age dwellings, what gracious creations of the Renaissance, how many interesting habitations of the seventeenth and eighteenth centuries, without speaking of the more modest dwellings or of the little Louis XVI *hôtels* which fashion has rehabilitated. These jewels form the unending chain which binds one with another these other monuments, immortal chefs-d'œuvre, which appear in the distance, brilliant symbols of an epoch of which they embody the aspirations and glorify the idea. But if the chain be broken, if its links be dispersed, these mighty chefs-d'œuvre thus isolated, will they not seem the strange and inspiring witnesses of an unaccountable epoch?

For, better than these monuments, works of private architecture reveal to us the intimate life of the people. The great monuments, sometimes erected slowly by several generations, seem rather to satisfy the general needs of society or those aspirations of human nature at the same time lofty and indefinite, being of all times, yet characterizing clearly not one.

One easily discovers that if a certain monument — a religious building, for instance — can be in harmony with different epochs, a similar piece of private architecture has its *raison d'être* only at a fixed period. Often, also, monumental buildings are the luxury of a nation. It places its glory in their keeping. It erects them with pride for posterity, so they are not always the sincere reflection of an epoch.

Private architecture, on the contrary, modelling itself upon the individual, will show more clearly to the historian or the philosopher the secret of the foibles or the virtues of a people who, in the intimacy of the domestic hearth, abandon themselves without dissimulation to tastes, inclinations and instincts.

In a word, monumental buildings are the poetry of our art; private architecture is its prose, but a living prose — prose, of a powerful

realism, which characterizes and retraces day by day the physiognomy of the individuals and the generations which pass.

Thus the Society has conceived that its encouragements ought to serve as a support to private architecture. It has desired that a deserving architect should know that not only some curious *confrères*, but that an entire society of architects take an interest in his works. More than this, it considers that the recompenses it decrees may some day draw the attention of Government upon artists worthy of its favors — the objects of the most laudable ambition.

We ought to recognize, gentlemen, that, although several of our laureates still await the supreme recompense, we have had the happiness to see our wishes favorably received in several instances; so let us accept with gratitude the results already acquired as a certain presage of future gratifications. Consequently, from the *résumé* which precedes and which I have the honor to lay before you in answer to a desire expressed by the jury, of which I am here the interpreter, the Society has decided to give public testimony each year of its esteem for that French architect whose single work, or group of works, outside of work for the State, the municipality, or any public bureau, that is to say, any private architectural work, shall be worthy of commendation: for a just distribution of the plan in perfect accord with the imposed conditions of the programme, whatsoever they may have been; for a good and intelligent construction, which takes especial account of the means which modern industry places at the service of the constructor: for the character of the architecture, for the logic of the decoration, for the rational study of the profiles and details, howsoever simple they may be; in short, for the delicate appreciation of form, and for the harmony and unity of the ensemble.

We can easily affirm that the two architects this year designated by the jury to receive the Grand Medals of the Society, fulfil wholly by their works the conditions imposed for these high awards.

Grand Medals of honor for private architecture are awarded to M. Louis Charles Boileau, architect, of Paris, and to M. Louis Garros, architect, of Bordeaux; a Medal of Jurisprudence to M. Alfred Normand, architect, of Paris, and a Medal of Archæology to M. Charles Chipiez, architect, of Paris.

ILLUSTRATIONS

[*Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.*]

THE (NEW) OLD SOUTH CHURCH, BOSTON, MASS. MESSRS. CUMMINGS & SEARS, ARCHITECTS, BOSTON, MASS.

[Gelatine Print, issued only with the Imperial and Gelatine Editions.]

THE TOMB OF THE CARDINALS D'AMBOISE, ROUEN CATHEDRAL. AFTER AN ETCHING BY E. S. GAUJEAN.

THIS magnificent monument in the Chapelle de la Vierge of Rouen Cathedral was erected in 1520–25 by a nephew (himself also a cardinal) of Cardinal Georges d'Amboise (1460–1510), Archbishop of Rouen and the favorite minister of Louis XII. The tomb is the work of Rouland Leroux, the master-mason of the Cathedral at that time, and the many "*imagiers*" who sculptured the statues under his directions. Its upper part is of marble and the rest of alabaster. The central portion, of white marble, bears the statues of the two cardinals kneeling in prayer. That of the nephew is of later date than the other, and its head is said to be the work of Jean Goujon. Behind the figures is a bas-relief of St. George and the dragon, on either side of which are three statues, representing respectively a bishop, the Virgin Mary, St. John the Baptist, St. Romain, a friar and an archbishop. The niches of the sarcophagus, separated by pilasters decorated with arabesques, and each surmounted by a small figure of a praying monk, contain six statues in white marble, the subjects of which are Faith, Charity, Prudence, Force, Justice and Temperance. The upper part of the monument shows six niches between pilasters, each of which holds figures of two of the apostles, and the intermediary niches are occupied by statues of prophets and sibyls. The dimensions of the monument are eighteen metres by twenty-four.

M. Gaujean, a native of Pau, and a pupil of Pils and Waltner, has etched this plate with a combination of delicacy and strength worthy of the beautiful monument it portrays. He won a third-class medal for etching in 1880.

The plate is reproduced from the pages of the *Moniteur des Architectes.*

LA SANTISIMA TRINIDAD, CITY OF MEXICO.

In the eighteenth century a very florid style of architecture became the favorite of Mexican builders, and being copied after a Spanish architect of the preceding century whose name was Churriguera, the name of *Churrigueresque* was given to it. Among several examples still remaining in the city the most notable are the Sagrario, or parochial church adjoining the great cathedral and seemingly a part of it, and the Church of the Most Holy Trinity (La Santisima Trinidad). The façade of the former will be presented on some future occasion in connection with a paper on the cathedral, supplementary to a paper and double-page illustration which has already appeared in this journal.

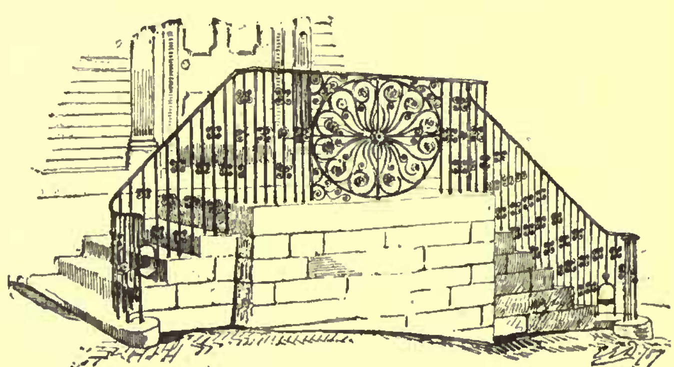
The illustration appearing herewith is of the Santisima Trinidad, or La Santisima, as it is generally called. It was begun in the year 1755 and completed somewhere about 1783. Being near the eastern borders of the city and rather out of the range of ordinary sightseeing, it escapes the attention of most visitors to the Mexican capital. Unlike most Mexican churches, it is rarely opened and has a generally-deserted appearance. This is not to be especially regretted for, its interior having been renovated comparatively recently by architects less skilled than those originally employed upon the church, it is scarcely worth a visit. The west front and south side are presented in the illustration. A long, low wing extends along the street front on the north, the window-frames being marvels of carving. It is to be regretted that the view of the graceful dome and lantern is obstructed by the tower.

THE YORK COLLEGIATE INSTITUTE, YORK, PA. MR. J. A. DEMPWOLF, ARCHITECT, YORK, PA.

THIS building, lately completed, has been erected on the site of a previous structure destroyed by fire, the design being materially influenced by the necessity of utilizing the old foundations. The material employed is local common brick laid in red mortar, with liberal trimmings of Hummelstown brownstone, the whole set on a continuous granite base. The tower forming the predominant external feature of the design, and the entrance-hall, which is arcaded and substantially treated in brownstone and granite, together constitute a memorial to the generosity and virtues of the original founder, Samuel Small, Esq., whose full-length portrait is placed over a carved stone mantel-piece in the latter room. Accommodation has been provided for two hundred and fifty students, with ample library, recitation and assembly rooms, the last named seating five hundred persons. The construction throughout is of the best, and the total cost, complete, is $70,000.

HOUSE FOR F. H. LEVEY, ESQ., ELIZABETH, N. J. MR. BRUCE PRICE, ARCHITECT, NEW YORK, N. Y.

ONE HUNDRED ARCHITECTURAL BOOKS.



Old WroughT IronworK Providence R.I.

TAKING a hint, perhaps, from the publication in the *American Architect* last February of a list of the "best twenty books for an architect's library," *Building News* some time ago asked its readers to send in lists of the best one hundred architectural books, and a few weeks ago published in their entirety three lists, which, on the whole, best met the editor's approval, and these lists we give below. It must be remembered that these lists are not, as ours was, the results of an analysis of all votes received, but are merely the opinions of single individuals which have received the endorsement of the editor of *Building News*. The list furnished by Mr. B. T. Batsford is in kind more like the list published in the *American Architect*, and it is probably the most valuable and trustworthy guide of any, since it is compiled from the sales-book of the leading English dealer in architectural books, and is, as it were, the analysis of a vote which is always going on, and gives the best practical proof of the value of a book — its popularity.

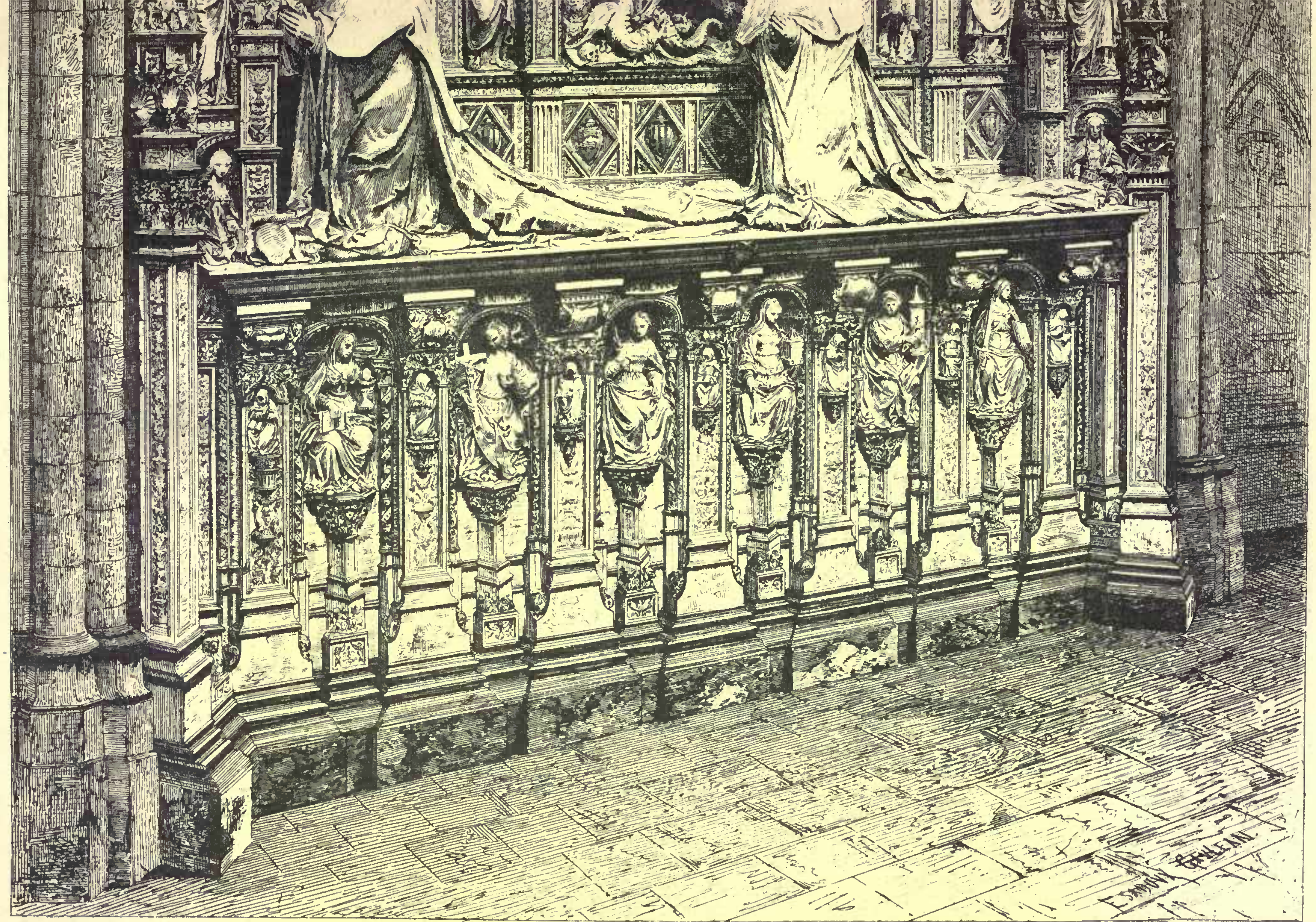
FIRST LIST. — BY "BOOKWORM."

No.	Title of Book.	Author.
1	Encyclopædia of Architecture	Gwilt.
2	Legal Handbook for Architects	Jenkins and Raymond.
3	Acoustics of Public Buildings	T. R. Smith.
4	Practical Brickwork	F. Walker.
5	Concise Glossary of Architecture	Parker.
6	Introduction to Gothic Architecture	Parker.
7	The Architect's Guide	Rogers.
8	Baronial Halls of England	S. C. Hall.
9	Analysis of Gothic Architecture	Brandon.
10	Open-Timber Roofs of the Middle Ages	Brandon.
11	Notes on Building Construction (3 vols.) Published by Rivington	



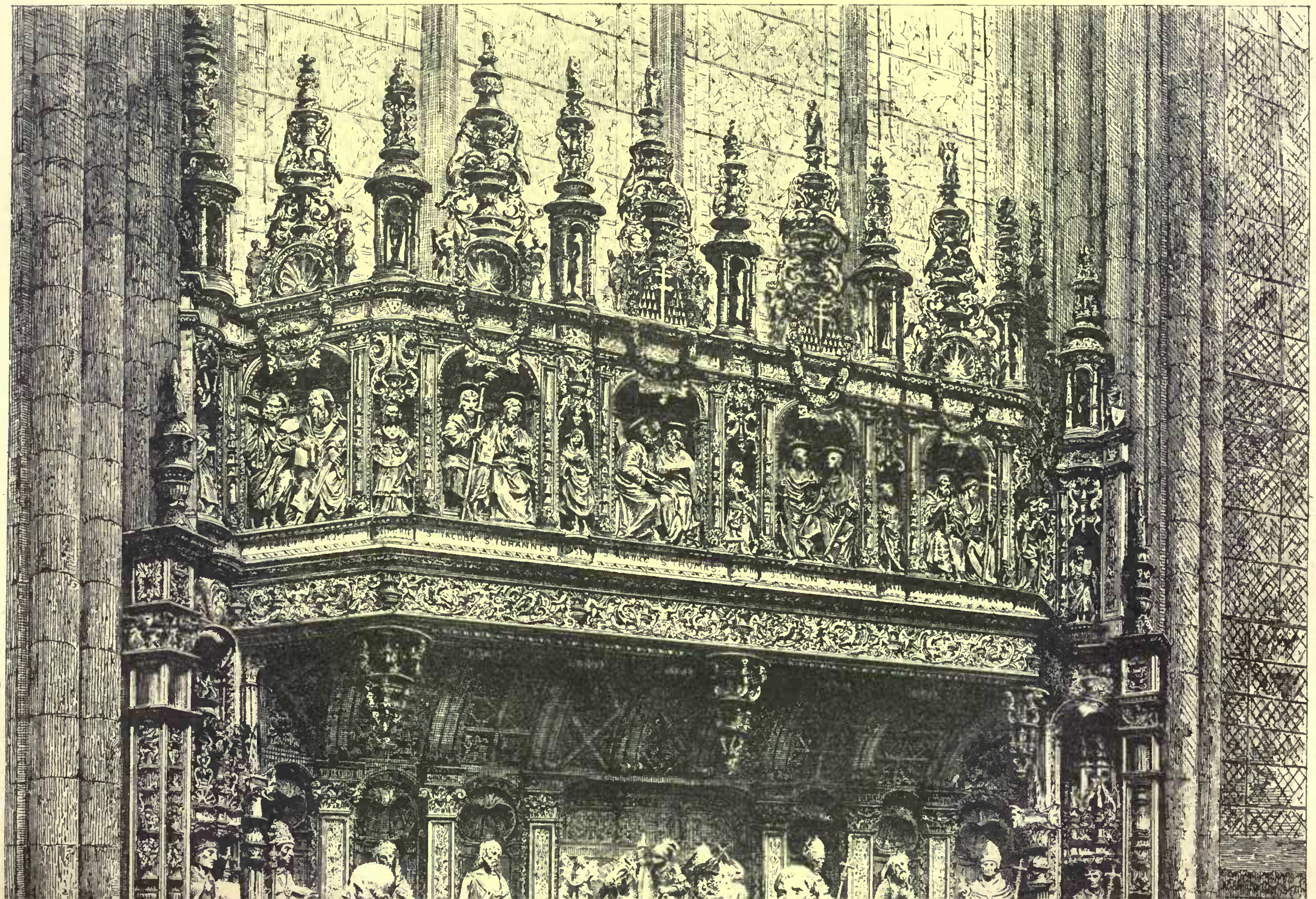
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Church of La Santisima Trinidad, Mexico.

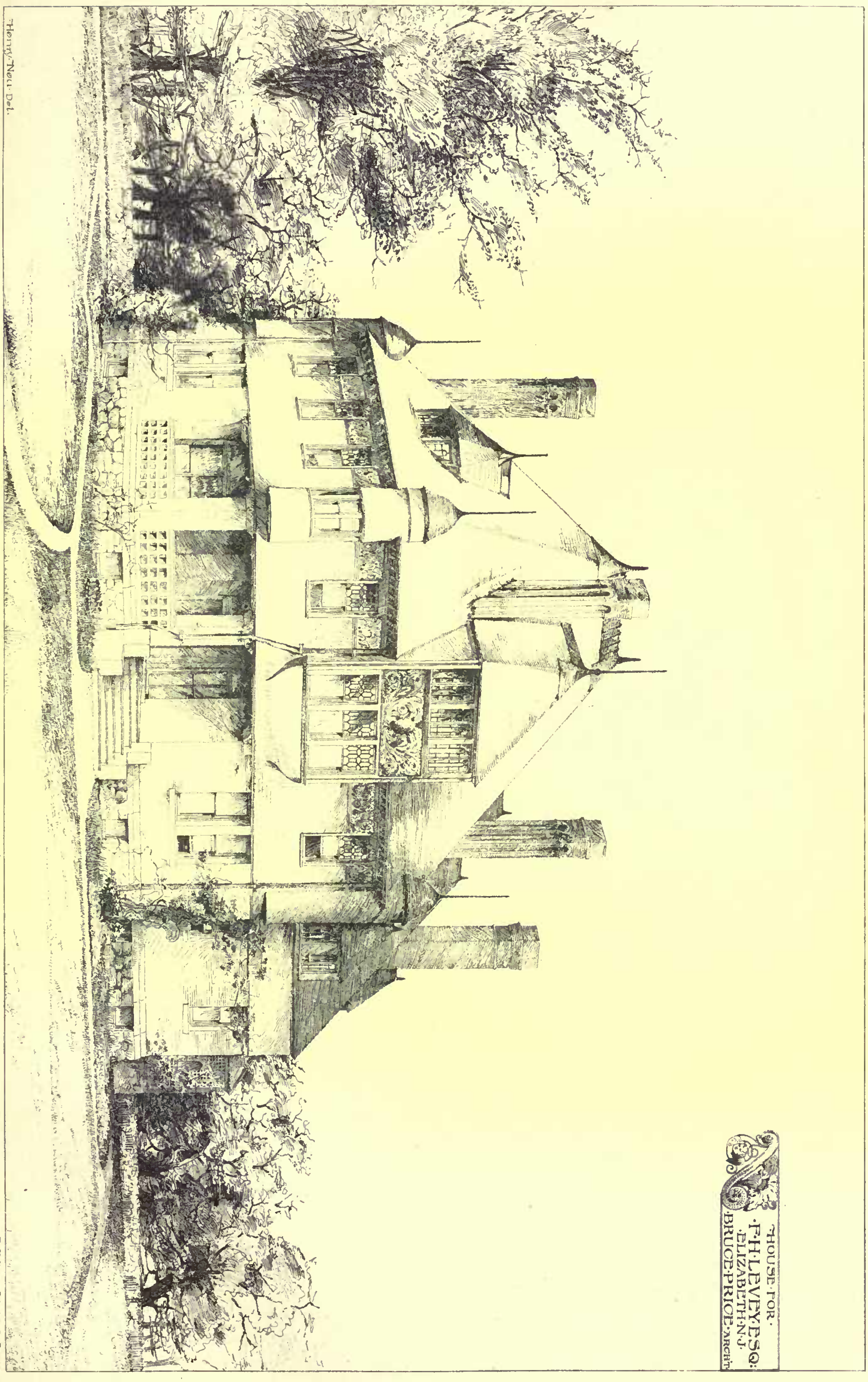


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AMERICAN ARCHITECT AND BUILDING NEWS, JULY 30 1887. No. 605



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17	Lattice-Girder Bridge	H. Adams.
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25	Contrasts	Pugin.
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27	Specimens of Gothic Architecture	Augustus Pugin.
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30	Lectures on Art	Ruskin.
31	Principles of Design in Architecture	Garbutt.
32	Normandy	Pugin.
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34	Strength of Materials	Barlow
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42	Grammar of Ornament	Owen Jones.
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55	The Gentleman's House	Kerr.
56	Mansions of England	Nash.
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58	History of Architecture in All Countries from the Earliest Times to the Present Day	J. Fergusson.
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60	Architectural Parallels	Sharpe.
61	Dictionary of Architecture	W. J. and G. Audsley.
62	Principles of Gothic and Ecclesiastical Architecture	Bloxam.
63	Handbook of Specifications	Donaldson.
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65	Light and Air	B. Fletcher.
66	Sketches in Spain	Smith
67	Architect's Sketch-Book at Home and Abroad	Thorpe.
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70	Theoretical and Practical Treatise on the Five Orders of Architecture	Nicholson.
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72	Four Books on Architecture	Palladio.
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75	Practical Geometry	Tarn.
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77	Construction of Roofs of Wood and Iron	Tarn.
78	Building Estates	Maitland.
79	Window Tracery	Freeman.
80	Domestic Architecture of the Middle Ages	Parker.
81	Strength of Materials	Anderson.
82	Strains	Stoney.
83	Pewtner's Comprehensive Specifier	Young.
84	Works on the Building Trades	Sedden.
85	Specimens of Mediæval Architecture	Nesfield.
86	Museums, Libraries, and Picture Galleries	Papworth.
87	Vaults of the Middle Ages	Prof. Willis.
88	Details of Ancient Timber Houses	Pugin.
89	Remains of Ecclesiastical Woodwork	T. T. Bury.
90	Shoring and its Application	Blagrove.
91	Strains	Humber.
92	Plumbing and House-Drainage	Buchan.
93	Trussed Beams, Cast-Iron Stanchions, and Riveted Joints	H. Adams.
94	Tracery	Paley.
95	Architecture — Gothic and Renaissance	T. R. Smith.
96	Illustrations of Geometric Tracery	Billings.
97	Churches of the Middle Ages	Bowman and Crowther.
98	Details of Gothic Architecture	J. K. Colling.
99	Practical Treatise on Natural and Artificial Concrete	H. Reid.
100	Studies from Old English Mansions	C. J. Richardson.

THIRD LIST. — BY H. H. RUMBLE.

No.	Name of Book.	Writer.
	INITIATIVE:	
1	Mathematical Instruments	J. F. Heather.
2	The Geometry of Compasses	O. Byrne.
3	Hints on Architectural Draughtsmanship	G. W. T. Hallet.
4	Perspective for Beginners	F. A. Wright.
5	Practical Rules on Drawing	G. Pyne.
	CONSTRUCTIVE:	
6	Gwilt's Encyclopedia	Gwilt.
7	Mathematics for Practical Men	O. Gregory.
8	Euclid — Books 1, 6, 11 and 12	Euclid.
9	Plane Co-ordinate Geometry	Todhunter.
10	The Differential Calculus	Todhunter.
11	The Integral Calculus	Todhunter.
12	The Science of Building	E. W. Tarn.
13	Graphic and Analytic Statics	Graham.
14	Handy Book on Strains, etc.	W. Humber.
15	Iron Bridges, Girders, Roofs, Etc.	F. Campin.
16	Building Construction	——
17	Brickwork, Treatise on	F. Walker.
18	Masonry and Stonecutting	Dobson.
19	Carpentry and Joinery	Tredgold.
20	Plumbing	Buchan.
21	Limes, Cements, etc.	Burnell.
22	House-painting, etc.	Davidson.
	SPECIFYING:	
23	Pewtner's Comprehensive Specifier	——
24	Handbook of Specifications	Donaldson.
25	Guide to Measuring and Valuing	E. W. Tarn.
	QUANTITIES:	
26	Quantity Surveying	B. Fletcher.
27	Surveyor's Hand-book	Hurst.
28	Manual of Earthwork	Graham.
29	Practical Measurer	Hoppus.
	ESTIMATING:	
30	By a Practical Estimator	G. S.
31	Price-Book, Spon's	——
32	Price-Book, Laxton's	——
	SURVEYING, ETC.:	
33	Trigonometrical Surveying	Frome.
34	Aid to Survey Practice	Jackson.
35	Architectural Surveying	Scott.
36	Mathematical Tables	——
37	Levelling	F. W. Simms.
	ARCHITECTURE:	
38	History of Architecture	Fergusson.
39	Indian and Eastern Architecture	Fergusson.
40	Seven Lamps of Architecture	Ruskin.
	ANCIENT:	
41	Ruins of Asia Minor	Texier & Pullan.
42	Architecture	Palladio.
	CLASSIC AND ROMAN.	
43	Architecture, Classic and Roman	Vitruvius.
44	Civil Architecture	Chambers.
45	Greek Ornament — plates only	——
46	Etchings of Ornamental Architecture	Tatham.
47	Manual of Architecture	T. Mitchell.
48	Classic, etc., Architecture	Smith & Slater.
49	Insignium Romæ Templorum	A. James.
50	Antichita Romane	Rossini.
	MEDIÆVAL, FOREIGN:	
51	Romanesque Architecture	V. Bunsen.
52	Continental Sketches	R. N. Shaw.
53	Byzantine Architecture	Texier & Pullan.
54	Architectural Studies in France	W. G. Davie.
55	Architecture of the Middle Ages in Italy	Cresy & Taylor.
56	Florentine Architecture	Ruggieri.
57	Stones of Venice	Ruskin.
58	French Renaissance	Daly.
	MEDIÆVAL, ENGLISH:	
59	Glossary of English Architecture	Parker.
60	Analysis of Gothic Architecture	Brandon.
61	Details of Gothic Architecture	Colling.
62	Examples of Gothic Architecture	A. and A. W. Pugin.
63	Gothic Mouldings	Paley.
64	Cathedral Antiquities	Britton.
65	Ecclesiastical Woodwork	Bury.
66	Baronial and Ecclesiastical Antiquities of Scotland	Billings.
67	Principles of Gothic Architecture	Bloxam.
68	Mediæval Architecture	Clutton.
69	Dictionnaire de l'Architecture	Viollet-Le-Duc.
	CIVIL:	
70	Domestic Mediæval Architecture	Parker.
71	Studies of Old English Mansions	Richardson.
72	Public Buildings of London	Britton & Pugin.
	ART:	
73	Grammar of Ornament	Owen Jones.
74	Initial and Ornamental Letters	C. Klimsch.
75	Early Christian Symbolism	Audsley.
76	Everyday Art	L. T. Day.
77	The Art of Illuminating	Tymms & Wyatt

78 Sketches for Art Furniture	A. Gouquet.
79 Lectures on Art	Ruskin.
80 Art and Work	O. W. Davies.
81 The Power of Form	Billings.
MODERN AND PRACTICAL:	
82 History of Modern Architecture	Fergusson.
83 The Gentleman's House	R. Kerr.
84 School Architecture	Robson.
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86 Report on Hospitals, L. G. Bd.	——
87 Farm Homesteads	Denton.
88 Schools, Asylums, etc., and Baths	C. Cacheux.
89 Warming and Ventilation	J. Billings.
90 Acoustics of Public Buildings	T. R. Smith.
91 Health and Comfort	Drysdale and Hayward.
92 Our Domestic Fireplaces	Edwards.
93 Dilapidations, Ecclesiastical and Lay	S. G. Grady.
94 Dilapidations, Ecclesiastical	B. Fletcher.
95 Dilapidations, Ecclesiastical	J. Elmes.
96 Compensations	B. Fletcher.
97 Arbitration	Fletcher.
98 Light and Air	Fletcher.
99 Dictionary of Architecture	E. Bosc.
100 Dictionary of Engineering	

B. T. BATSFORD'S LIST.

GENERAL AND HISTORICAL WORKS.

1 D'Agincourt's History of Art by its Monuments. Translated by Owen Jones. Folio.
2 Fergusson's History of Architecture, including Indian and Eastern and Modern Styles. 4 vols. 8vo.
3 Gailhabaud, Monuments Anciens et Modernes. 4 vols. 4to.
4 Gailhabaud, l'Architecture et les Arts qui en dependent (v. au xvii. siècle) 4 vlos. folio.

CLASSIC ARCHITECTURE.

5 Stuart and Revett's Antiquities of Athens. Original Edition. 4 vols. folio.
6 Taylor and Cresy's Architectural Antiquities of Rome. Original Edition. 2 vols. folio.
7 Penrose's Principles of Athenian Architecture.
8 Palladio's Four Books. Translated by Leoni or Ware.
9 Sir Wm. Chambers's Decorative Parts of Civil Architecture.

BYZANTINE AND ROMANESQUE.

10 Hubech, Monuments de l'Architecture Chrétienne. Folio.
11 Gally Knight's Ecclesiastical Architecture of Italy. 2 vols. folio.
12 Revoil, Architecture Romane du Midi de la France. 3 vols. folio.
13 Texier & Pullan, Byzantine Architecture.

GOTHIC AND RENAISSANCE — ENGLISH.

14 Billing's Baronial and Ecclesiastical Antiquities of Scotland. 4 vols. 4to.
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16 Britton's Architectural Antiquities. 5 vols. 4to.
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18 Brandon's Analysis of Gothic Architecture. 2 vols. 4to.
19 Brandon's Open-Timber Roofs. 4to.
20 Brandon's Parish Churches. Impl. 8vo.
21 Colling's Details of Gothic Architecture. 2 vols. 4to.
22 Colling's Gothic Ornaments. 2 vols. 4to.
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24 Dollman's Examples of Ancient Pulpits.
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35 Richardson's Specimens of the Architecture of James I. 4to.
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43 Anderson's Examples of Municipal and Commercial Architecture of France and Italy. 12th to 15th Century. Folio.
44 Cicognara's Fabriche di Venezia. 2 vols. folio.
45 Daly's Motifs Historiques d'Architecture et de Sculpture d'Ornement. First and Second Series. 4 vols. folio.
46 Fritsch, Denkmaler des Deutscher Renaissance. Parts I to X. (to be completed in 12). Folio.
47 Johnson's Specimens of Early French Architecture. Folio.
48 King's Study Book of Mediæval Architecture and Art. 4 vols. 4to.
49 Letarouilly, Edifices de Rome Moderne. 3 vols. folio, and text. 4to.
50 Nesfield's Specimens of Mediæval Architecture. Folio.
51 Nicolai, Das Ornament der Italienischen Kunst der XV Jahrhunderts. Folio.
52 Petit (Victor) Châteaux de la Vallée de la Loire. Folio.
53 Pugin and Le Keux, Specimens of Architectural Antiquities of Normandy. 4to.
54 Cotman's Architectural Antiquities of Normandy. Folio.
55 Rohault de Fleury, Le Toscane au Moyen Age. 2 vols. folio.
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57 Ruskin's Stones of Venice. 3 vols.
58 Shaw (R. Norman), Architectural Sketches from the Continent. Folio.
59 Street's Gothic Architecture in Spain. 8vo.
60 Street's Brick and Marble Architecture in Italy. 8vo.
61 Verdier et Cattois Architecture Civile et Domestique, 2 vols. 4to.
62 Wyatt (Sir M. Digby), An Architect's Note-book in Spain. 4to.
63 Viollet-le-Duc's Dictionnaire Raisonné de l'Architecture Français. 10 vols. 8vo.
64 Grüner's Terra-Cotta Architecture of North Italy. Folio.

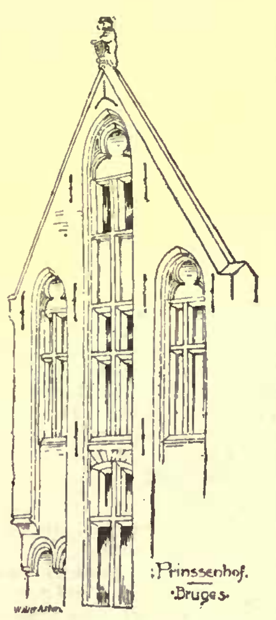
ORNAMENT AND DECORATION.

65 Owen Jones's Grammar of Ornament. Folio.
66 Pugin's Glossary of Ecclesiastical Ornament. 4to.
67 Daly (César) Decorations Interieures Peintes. 2 vols. folio.
68 Grüner's Fresco Decorations from Palaces and Churches in Italy. Folio.
69 Zahn's Ornamente aller Klassischen Kunstepochen. Folio.
70 Heffner-Alteneck, Serrurerie du Moyen Age et de la Renaissance. 4to.
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74 Bourgoin's Les Arts Arabes. Folio.

MODERN CONSTRUCTION.

75 Daly (César) L'Architecture Privée, 1st and 2d series. 6 vols. folio.
76 Varin, Architecture Pittoresque en Suisse.
77 Ballard, Monographie des Halles Centrales de Paris. Folio.
78 Gousset, Traité de la Construction des Theâtres. Folio.
79 Viollet-le-Duc's Lectures on Architecture, translated by Bucknell. 2 vols. 8vo.
80 Kerr's English Gentleman's House. 8vo.
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88 Notes on Building Construction (Rivington). 3 vols. 8vo.
89 Tredgold's Principles of Carpentry, by Barlow or Hurst.
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97 Emden's Building Leases and Building Contracts.
98 Jenkin's and Raymond's Legal Handbook for the Architect.
99 Fletcher on Quantities. Cr. 8vo.
100 Fletcher on Dilapidations. Cr. 8vo.

DISCOVERY OF THE GREAT TEMPLE OF BUBASTIS.



It would be difficult, says the *London Times*, to point to any group of mounds in Egypt which is seen by so many travellers and visited by so few as that of Tell Basta. These mounds are situate within a few hundred yards of the railway which connects Cairo with Ismailis, and are about half-a-mile distant from Zagazig station, the meeting-point of three converging lines. All who are on their way to or from India via Cairo or Alexandria pass that way; and to all, unless they travel by night, the heights of Tell Basta are conspicuously visible. Lofty and rugged, their broken and blackened summits standing out against the clear Egyptian sky, they look like the wreck of a cluster of extinct volcanoes. They represent, however, the wreck of a once great and famous city — the Pi-Bast of ancient days, the Bubastis of the Greeks, the Pi-Beseth of the Bible. Yet no one alights to visit those hills of crumbling ruin. "*Murray's Guide*" states that there is nothing at Zagazig to detain the passing traveller; and Baedeker says that the great temple described by Herodotus as the most beautiful in Egypt, has entirely disappeared. Six or eight weeks ago both Murray and Baedeker were correct; but they are correct no longer.

M. Naville, whose excavations at Tell-el-Yahoodeh were described in our columns a short time back,[1] has since then transferred the pick and spade of the Egypt Exploration Fund to the neglected rubbish-heaps of Tell Basta, where his exertions have been signally rewarded by the recovery of some stupendous remains belonging to what must once have been one of the most magnificent edifices of Pharaonic Egypt.

Attracted by the reported discovery of a group of tombs at or near this place, M. Naville accompanied by Mr. F. Llewellyn Griffith, and subsequently joined by Count d'Hulst, both officers of the Fund — shifted his camp to Tell Basta about the middle of April. He had but one month left at his disposal, and nothing was farther from his intentions than to commence a great excavation. The tombs proved, however, to be a myth; and — with a slight hope of finding anything important at a site unsuccessfully attempted by the late Mariette Pasha — he decided to sink some pits in the bed of the great central depression which marks the area of the temple. This depression is distinctly quadrangular, and is hemmed in by heights composed of innumerable strata of brick buildings; thus exactly verifying the celebrated description written twenty-three centuries ago by Herodotus. The old historian says:

"The temple stands in the middle of the city, and is visible on all sides, as one walks round it, for as the city has been raised up by embankment, while the temple has been left in its original condition, you look down upon it wheresoever you are. A low wall runs around the enclosure, having figures engraved upon it, and inside there is a grove of beautiful tall trees growing round the shrine which contains the image of the goddess. The enclosure is a furlong in length and the same in breadth. The entrance to it is by a road paved with stone for a distance of about three furlongs, which passes straight through the market-place with an eastern direction, and is about four hundred feet in width. Trees of an extraordinary height grow on each side the road which conducts from the temple of Bubastis to that of Mercury." (Book II, chap. 138.)

Such was the great temple in the plentitude of its prosperity; yet so completely had it vanished that archæologists took its utter destruction for granted. The main features of the scene were, however, still traceable. The square hollow defined the temple area. A break in the continuity of the surrounding mounds marked the site of the gateway. The long line of the street leading from the temple of Bast to the temple of Thoth (identified by Herodotus with Mercury) was yet visible. Here and there lay a weather-worn block of granite, and yonder yawned the mouth of one of Mariette's deserted pits. To go to work in a small way upon so large and hopeless-looking a site would be to court the same disappointment which befell Mariette. If anything remained to be found it must be sought over a considerable area and by plenty of seekers. So M. Naville beat up the neighborhood of Zagazig for laborers, assembled a gang of some two hundred fellaheen, and attacked the quadrangular enclosure in three places at once. To his surprise and delight, the results were as immediate as they were unexpected. One excavation disclosed a number of superb monolithic columns and massive architraves, all of red granite, and all prostrate and broken. Another brought to light a wilderness of sculptured building-blocks, crowded with bas-relief groups and hieroglyphic inscriptions. These also were of red granite. The columns bore the cartouches of Rameses II; the blocks were engraved with the names and titles of Osorkon II of the 22d dynasty, who reigned some three hundred and eighty years later.

As the work progressed the ruins became more intelligible. The temple was oriented from east to west, and the place of columns proved to be the hypostyle hall. Beyond this, farther to the westward, the pit of sculptured blocks represented a second great hall; while beyond this again, the third pit yielded constructions of a still later date, forming apparently the end of the temple. This part also was in red granite; and here was found the name of Nekhthorheb, who ruled about four hundred and eighty years later still. Hereupon, M. Naville concentrated his forces upon the two older spots, increased the strength of the little army of diggers, and tasked himself to clear as much as possible of the halls of Rameses and Osorkon. Soon he had four hundred hands — men, boys and girls — working from sunrise to sunset, with only an hour and a half's rest at mid-day. Thus vigorously pushed, the excavations made rapid progress. Fallen columns of the beautiful clustered lotus pattern with lotus-bud capitals, architraves emblazoned with royal insignia, heads, trunks, and limbs of collossal statues, some in groups of three together and some in pairs, emerged from the grave in which they had lain, forgotten and mutilated, for unknown centuries. Each day revealed more and more monuments, and every monument was history. The lotus columns, though inscribed by Rameses II, were of the 12th dynasty workmanship, and told the usual tale of usurpation. By-and-by, the name of Usertesen III turned up, thus carrying back the date of the temple to the time of the first great Theban empire; and some days later, a still more important stone was found, inscribed with the cartouche and titles of Pepi Merira of the 6th dynasty — one of the last pyramid-building kings of the ancient empire, and founder of the earliest temple of Denderah.

Meanwhile it became evident that there were scarcely any statues in the hypostyle hall, but that the great hall of Osorkon, in which there were no columns, must have been crowded with groups and single figures. At the entrance lay two shattered colossi of Rameses II, in black granite, wearing the crown of Upper Egypt. Some notion of their size may be gathered from the fact that the eyes are seven inches in length. Near these lay two smaller colossi of the same Pharoah, the lower limbs shattered, but the upper halves uninjured; to say nothing of two others in green granite, two in red granite, and several groups representing Rameses enthroned now with a god and now with a goddess. The ostentation with which the Pharoah of the Oppression multiplied his own image throughout the temples of Egypt is well known; but nowhere, unless at Tanis, does he seem to have indulged his portrait mania more extensively than at Bubastis. Several mutilated groups of two or three colossi together have likewise been found, and we shall probably not be far wrong if we attribute these also to Rameses II. Though not one of the foregoing statues is unbroken, many of the heads, strange to say, have escaped without damage; inter alia, a beautiful and unique specimen in red granite, wearing the helmet of Osiris, and another in black granite with the crown of Upper Egypt. The former, which has fallen to the share of the Egyptian government, is already on view at the Boulak Museum, and the latter is on its way to England. Here, also, in the great hall of Osorkon, were discovered a standing statue of a governor of Ethiopia bearing the customary title of "Royal Son of Kush;" a limestone group of a priest and priestess engraved with an interesting geographical inscription (26th Dynasty); a small statue with the name of Achoris, a king of the 29th Dynasty, who reigned but ten years (B. C. 393–383), and whose monuments are of the rarest; and a fine squatting statue in black granite of Prince Menthuherkhopeshef, a son of Rameses II, who wears the sidelock of youth (a fashion still universal in Nubia) and is entitled "General of Cavalry of his Father." All these are comparatively perfect, and will shortly be exhibited in London by the Egypt Exploration Fund. The last is work of some earlier dynasty, usurped for the prince with the unpronounceable name — which signifies, by the way, "Lofty Mentu (Mars), his scimitar" — the older inscriptions being erased to make way for the newer.

Of greater historical interest, however, than the portrait statues, are the sculptural blocks which lie piled in unimaginable confusion on the site of Osorkon's hall. These blocks lined the walls, and the bas-reliefs with which they are closely covered formed, when *in situ*, one huge tableau, or perhaps two tableaux representing a great festival given by the king, most probably on his coronation day. Though cut up into as many sections as there are blocks, it is yet possible to gather something of the subject. Here were processions of priests bearing standards and offerings; other priests two and two, carrying shrines and sacred boats supported by long poles upon their shoulders, as we may imagine the Israelites carrying the ark of the covenant. Osorkon, wearing sometimes the crown of Upper Egypt and sometimes the crown of Lower Egypt, occurs over and over again, generally with the cat-headed goddess Bast by his side. He offers incense and libations to various gods, or is himself worshipped as a deity by the priests. Occasionally he is seen with his queen, Karoama. Most curious of all are some subjects representing religious dances or gymnastics executed by the priests, some of whom make fantastic gestures, while others lie flat upon the ground. Nothing in the least resembling this strange ceremony has previously been discovered upon the monuments. A fragmentary inscription, of which it is to be hoped the rest may yet be found, makes record of a festival "which takes place every fifty years." Osorkon may have timed his coronation to coincide with that festival, or the festival may have been ordained to commemorate the coronation, but any such explanation is for the present conjectural. The entire hall, which M. Naville entitles "the festive hall," was constructed of red granite, all the sculptured surfaces being without polish. Were money, time and labor of no account it would be well worth while to rebuild these blocks in their original order and so restore the whole subject; but as it is the next best thing is, of course, to obtain paper impressions, which can afterward be arranged in sequence and even reproduced as plaster casts. This, as far as was possible in the time, has been done. The main difficulty was to turn and lift such huge fragments. For this work M. Naville engaged a gang of stalwart "shayalin," or porters; a class of men who find employment at Zagazig during the cotton season, and who, with strong ropes and strong arms, did good service on the present occasion. An eye witness of the scene wrote:

"Nothing is more exciting than to watch these enormous blocks turned over; thus showing inscriptions which have been concealed for centuries. The difficulty of turning them may, however, be imagined when a mass weighing several tons is wedged in between three or four huge fragments of colossal statues, with not one foot of terra firma for the men to stand upon. Once raised, a block of only a few hundredweight is slung between poles, and easily carried to a clear space on the brink of the excavation. The bigger ones are lifted and turned by means of rollers and levers between two long lines of ropes. The sheikh of the "Shayalin" dresses the lines of men with his stick (which he also uses freely about their backs), and marks the time by shouting some sing-song and well-accentuated phrase. When at last the block moves it often happens that a statue — till then completely hidden — appears from underneath. The work of taking paper impressions has become very heavy, and there was much rejoicing when Count d'Hulst arrived the other day to the assistance of M. Naville and Mr. Griffith. I watched him yesterday going from block to block, clearing the sand and soil from

[1] See "The City of Onia and the Mound of the Jew," *The Times*, April 20.

the hollows of the hieroglyphs, washing the sculptured surface, damping the paper, and taking the impressions. Wherever he went he was followed by a fellah woman carrying a big bowl of water, which she continually refilled. The scene is altogether very curious, as one looks down into these vast excavations, swarming with hundreds of laborers, and literally piled with what looks like a berg-fall of granite and porphyry blocks."

The historical results thus far go to prove that Osorkon II, of whom little has hitherto been known, must have been the most powerful monarch of the Bubastite line. Like the great temple of Denderah, and perhaps also that of Tanis, the original sanctuary upon this spot would seem to have been founded by Pepi I (6th dynasty), whose place in history, according to Brugsch, is about 3,300 years before the Christian era. It was probably rebuilt about a thousand years later by Usertesen III (12th dynasty), again partly rebuilt, or much enlarged and enriched, a thousand years later still by Rameses II (19th dynasty). Some 460 years after Rameses II it was taken in hand by Osorkon II, who added the festival hall, and perhaps yet more buildings at the eastward end. Last of all, about B. C. 380, we find Nectanebo I making additions at the western extremity of the pile behind the sanctuary. The history of the temple may therefore be said to extend over a period of more than 3,200 years.

BOOKS AND PAPERS.

ONE of the most unique and interesting characters in the history of art is that of Hans Holbein, the younger,[1] that giant of the early painters, that Raphael of Germany, and the connecting link between the Gothic and the Renaissance art. His name is familiar to every one who has the least acquaintance with art, although few are able to thoroughly appreciate his genius who have not had the privilege of studying his work in the place where it was produced; and thoroughly seizing the delicate way in which he combined the romantic pose and poetic imagination of the Gothic period with the precision of drawing, the feeling for style, and the noble composition of the early Renaissance.

Hans Holbein was born in 1497 in the great city of Augsburg, at once the centre of the reformatory movement and the commercial activity of Germany, and which more than any other city was calculated to awaken the imagination of the artist, to stimulate his ambition and to encourage his drawing. The father of Holbein we know as a second or third rate artist who shines chiefly by reflected light. Holbein the younger spent only his early boyhood in Augsburg, leaving his native place at the age of nineteen and establishing himself at Bâle where he found very congenial occupation in painting as well as in drawing, engraving and doing other work in connection with the great publishers who had established themselves in that city. Nearly all of his best works were produced in Bâle, and it was only in his middle life that he left the city and went to England, where he passed several years, occupying a high position as court painter to Henry VIII, and making a quantity of paintings and drawings of the high personages of English society. Henry the VIII took a special interest in Holbein and honored him with many marks of his countenance, especially showing his appreciation of the German painter's taste by sending him to make the portraits of the women whom he proposed to marry, being certain that no one could furnish him such exact details about them as he would have from a drawing by Holbein. The latter part of Holbein's life was divided between Bâle and London. He had married in his youth a native of Bâle who was by no means congenial to him, and doubtless the unhappiness of his marriage led him to journey back and forth, and kept him from fixing himself in either place. He died in 1543 at the age of forty-six.

Modern taste can better appreciate Holbein by his drawings, for it should be noted that color is not in general the striking merit or the chief idea of the master. The casual traveller through Europe is apt to think of Holbein as dreary and uninteresting, for his best work is hidden in a very inconspicuous gallery at Bâle, and few of the ordinary tourists ever care to spend the time necessary to thoroughly study his work there. All of his works in this gallery have a special interest, in that they are mostly the creations of his youth, and are strong and audacious in style and treatment, to a certain extent unequalled by any of his later undertakings. The artist who has been able to study the pencil drawings of Ingres, will appreciate how truly he thought in the same lines as Holbein, and though the style of the two painters is, of course, radically different in their painting and pencil studies, still where the element of color is not looked for one can see a striking resemblance in the purity of lines employed, in the seeking for noble outlines, and in the care and precision with which details of texture, modelling, etc., are indicated by a few apparently careless touches. And yet, curiously enough, one of the most striking of his pieces in the Bâle Museum is a painting of the dead Christ. Wonderfully strong in the character of its head, and the impressive, powerful expression of sentiment which is given to the face, this picture made Holbein's reputation when it appeared, and obtained for him many important commissions. Another gem of the collection is a large drawing of the family of Thomas Morus, as our biographer expresses it, or more truly, Thomas More; a drawing in crayon, where each figure is represented by a single contour made with the pen, so incisive in its character that a painting skilfully modelled could not give a more striking impression of resemblance. Indeed, it was Holbein's peculiar power to be able to indicate rather than to draw in detail; to express all the infinite modulations of a face with a few simple contour lines; to abbreviate and yet tell everything that could be told; to seize on the essential in a picture and yet represent that essential so faithfully that one received the idea, in looking at it, of an entirely finished study. This is one of the great qualities which come not by patient skill, but is born in the artist, and Holbein, in all the long range of art, is preëminently the man who could draw in outline.

In the Dresden gallery there is a very celebrated painting by Holbein, the Virgin of Jacob Meyer, which German enthusiasm has not feared to place in direct opposition to the Sistine Madonna. M. Rousseau disposes of the painting in a very happy way, which is expressed so neatly in his own language that we cannot refrain from giving it here:

"*La bonne Vierge bourgeoise qui ne s'est pas refusée à poser pour le peintre. Elle est belle, aimable et douce, mais d'une douceur tout humaine; elle est entrée familièrement chez le bourgmestre Meyer et foule son tapis, laissant le bonhomme frôler sa robe de sa grosse tête massive et penchant elle-même, d'un air encourageant, sa blonde tête germanique vers les demoiselles qui disent leur chapelet.*"

The fact is, Holbein was too practical and keen-sighted, and lived too closely upon the verge of a great social and religious revolution to be able to paint Virgins with anything like a heavenly expression, or to put into their faces any measure of the divine feeling which has immortalized Raphael. Setting aside the question whether any German could ever paint a Madonna, neither his time nor his talents fitted him for that department of art. He was preëminently a portrait painter. It was during the later years of his stay in Bâle that Holbein composed and drew the famous "Dance of Death," a series of forty-five little vignettes representing the various conditions of life from the emperor to the beggar, and illustrating the nearness of death and the shortness of life. This was a theme that was very dear to the late German Gothic painters, and Holbein had plenty of ideas to draw from, but he sounded the last note in the long series, and his unique and interesting drawings are in some respects his most individual production. Holbein immortalized the court of Henry VIII, as did La Tour the court of Louis XV. The portraits preserved of Henry the VIII and his favorites, the ministers, bishops and dignitaries of his time are invaluable, both for their accuracy and for their intrinsic worth. Unfortunately, a number of them have suffered by fire, and a great many of Holbein's works, executed in England, are lost entirely. Thus, he was commissioned to decorate the Privy Chamber at Whitehall, and he did some work of a decorative character, which, of itself, would have been sufficient to have fixed his renown as a painter; but all that remains to us now are some fragments of sketches, themselves partially destroyed by water and fire. One treasure has, however, been maintained almost intact, and it is perhaps the most extraordinary and marked by superior work that Holbein executed, the series of portraits of the court of Henry the VIII, which are preserved in Windsor Palace.

While less perfect than the Italian masters, Holbein is perhaps more astonishing by the variety of his aptitudes, but as an artist his glory is drawn entirely from his drawings; his most beautiful paintings add nothing to his fame. They seem to have limited his talent and his execution in a sort of finish a little too uniform, too smooth, too equal, with dark tones which repeat themselves too often. The drawings, freer and more varied in character, give the idea of a larger, much more supple art; with them nothing lacks, feeling, color, touch, all is indicated by simple lines. The pencil expresses everything; the texture of the drapery, the glistening of the steel, the half begun movements and the delicacies of expression. No one has succeeded so thoroughly as Holbein in seizing the essential elements of a portrait, and that is what renders his least sketches more striking, more speaking than are the best of photographs, where details, though insignificant, disguise the true physiognomy and which, while being infallibly exact, are often so little like the original.

ONE is tempted to adopt the Ollendorffian method in examining this ingenious little manual[2] of sanitary advice, and to some of its apparently-idiotic questions return the kind of answers that the old saw recommends one to accord to folly — to reply, for instance, to the question "Do you provide the children with pure milk, and with food containing mineral salts?" that we prefer to give our children swill-milk and our cook is allowed to use none but animal salts. The member of the female junta of authors who propounds the above conundrum, and the others in the chapter on food and drink, can, it seems to us, hardly have had much experience with housekeeping cares or maternal duties. Her style is more suggestive of the school-room than that used by her associates, and her use of big words where little ones would do is irritating. It is difficult to decide which is the more comical, the wording of the following question or

[1] "*Les Artistes Célèbre; Hans Holbein,*" par Jean Rousseau. Paris: J. Rouam, Editeur.

[2] "*Home Sanitation.*" A Manual for Housekeepers. By the Social Science Club of the Association of Collegiate Alumnæ. Boston: Ticknor & Co, 1887.]

any of the answers that a person with even a slight sense of humor would be likely to give — "Do you quietly supervise the weekly dietary, so that a due proportion of the essential food-elements are set before the family in a palatable form?" Fortunately, the pedagogic style is not so apparent in the other chapters, and though now and then we meet something which makes us want to ask questions in our turn, as, for example, why must Venetian blinds be banished to the piazza, or why may not our inside shutters have slats, or may we not open our chamber windows as soon as we get out of bed, instead of waiting until we are dressed? the greater part of the questions are reasonable and appropriate in their suggestiveness.

The fact that the book has the air of being made up wrong end foremost has made us follow the same course. So, having paid a little attention to the cart we will now have a look at the horse that draws it. In the make-up of school-books we know it is often customary to give the discussion of the subject, and then add a number of questions, the elucidation of which is supposed to be aided by the preceding explanations, and that method has been followed here, mistakenly, we think. We believe that the true method of teaching history, for instance, is to begin not with the beginning of the world and plod along for ages in darkness and dulness, but to begin with the history of our own times and then hark back on the records of the past in search of the causes of events and social movements. In this way the study acquires life and real interest. So in this case we would have put the questions first and so stimulated inquiry, and awakened interest, and then the explanations would have had more force and meaning. In spite of this drawback, as the book is simple, direct, concise, and in the main sensible and correct, it should prove a popular little hand-book for the housekeeper whose intelligence is just awakening to the importance of sanitary surroundings.

The book is the product of the studies of the Sanitary Science Club of the Association of Collegiate Aluminæ — we had not realized, until this sounding title put us on inquiry, how many institutions there are which graduate females either alone or in conjunction with males — and is intended to teach housekeepers how the dwellings over which they rule may be kept sane and sound, and for the purpose it should serve exceedingly well. It is not very deep, but then the details of daily life do not seem very deep either, though there is none so simple that, if properly studied, does not assume portentous proportions; but as few have time or inclination to study deeply, it is convenient to have things boiled down and condensed by other people ready for immediate assimilation as soon as swallowed. The distinguishing feature of the book is the ingenuity displayed in wording the questions so that if the reader can answer them in the affirmative she may consider that in the opinion of the members of the S. S. C. A. C. A., she is fit to herd with the sheep. We fear, however, that the answers we should be constrained to give now and then would only allow us to be folded with the goats.

MESSRS. JOHN WILEY & SONS have just published a catalogue[1] of their publications, which they would be glad to mail to any applicant for it. In conception it differs from any catalogue that we remember to have seen: it gives the title-page of each book in full, and then, in place of the syllabus of its contents, which is usually added by publishers when they wish to give an idea of the value the purchaser may expect to receive, Messrs. Wiley devote the page facing the title-page of each work to extracts from reviews to which the book has already been treated by the technical press of America and England. Of course, these extracts are such as commend the book under review more or less unqualifiedly, but this bit of commercial acumen is the less obnoxious for the reason that there are few publishers who exercise the same amount of discretion in selecting works for publication as do the Messrs. Wiley. We always feel that a technical work which bears their imprint, if not the best of its kind, is at least good, and always worth careful weighing before deciding that a better book on the same topic can be found elsewhere.

SOCIETIES

MASONIC ART ASSOCIATION.

THE Freemasons of Philadelphia are taking active steps looking toward the formation of a Masonic Art Association which shall have for its object the purchase of suitable works of art to adorn the Masonic Temple in that city, which building is said by members of the craft who have travelled extensively to be the finest building devoted to Masonic purposes in the world. The object is to form an association composed of members of the fraternity as individuals, and the money, raised from a small annual assessment upon its members, will be employed at the discretion of the committee having the expenditure of the money in frescos, stained-glass windows, pictures or statuary as may be deemed most appropriate. As a number of well-known artists and architects are members of the fraternity in Philadelphia, such as John Sartain, Thomas U. Walter and James H. Windrim, it is quite likely that the committee will be composed of men well able to perform the task intrusted to them, and in time the collection of art objects thus secured will prove not only of value to the fraternity, but of interest to all lovers of art. Even now a great many people visit the building to see its noble proportions and the beauty of its interior on the day when it is open to the general public, and it cannot fail to attract greater numbers of visitors after this association shall have been in existence for a few years.

[1] "*Practical Works and Text-Books on Civil, Mechanical, Mining and Marine Engineering*," etc., containing full titles, descriptions, and press-notices selected from the latest catalogue of our publications. New York: John Wiley & Sons, 1887.

COMMUNICATIONS

RIVETING-MACHINE MAKERS.

July 14, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — Will you kindly inform us whom we may address to obtain cuts and further information of the riveting-machine described in the editorial columns of your issue of the 9th inst.? and oblige,

Yours very truly, X.

[WE find the description and cuts in the *Revue Industrielle* of 12th May, 1887. The machine is made by Varlet & Co. Probably a letter addressed to MM. Varlet et Cie, Ingenieurs-Mecaniciens, Paris, France, would reach them. — EDS. AMERICAN ARCHITECT.]

NOTES AND CLIPPINGS

THE OLD SENATE HOUSE AT KINGSTON, N. Y. — Before the title of the Old Senate House, Kingston, can pass to the State, the Trustees of Public Buildings of the State, consisting of the Governor, Lieutenant-governor, and Speaker of the Assembly, must receive a statement that the cost of putting the building in repair, beautifying the grounds, etc., will not exceed the sum appropriated. The amount remaining of the appropriation of $12,000, after paying the purchase price of the place, will be about $3,000. All the repairs must be kept within this sum. Contractors have examined the building, and as soon as Mr. Perry, the State architect, makes plans for the work to be done the contractors will prepare estimates of the cost of the same. Valentine Burgevine, a Kingston florist, has made a plan to beautify the yard at the side and rear of the building with walks, beds of plants, vines, and flowers.

Many repairs are needed to the building. A new roof must be put in, the woodwork painted, walls repaired, etc. Several changes having been made by former tenants, considerable work will be required to put the building back to its original condition. The old Dutch oven in the kitchen, which was taken out several years ago, will be replaced. The large fireplace, now closed, will be opened and put as nearly in its original condition as possible. In some of the windows there are new-fashioned sashes. These will be replaced by old-fashioned sashes containing old-fashioned panes of glass. It is thought that all the repairs and improvements can be made within the $3,000. When the contracts for these are made the deed will be given and the title passed to the State. A keeper will then be appointed by the Trustees of Public Buildings. — *New York Tribune.*

FIBROUS STEEL. — Steel is scoring another point in its contest with iron. Ironmasters who, as sheet and plate and angle makers, have been suffering acutely from the distinct advance which steel has made as a metal possessing bending and shaping qualities, have hitherto assumed that, however malleable the opposing metal may become, it is unlikely to attain to a fibrous quality. The grand fibre which distinguishes the best qualities of Yorkshire and Staffordshire iron has been held to be a fortress impregnable to all the assaults of the most accomplished of the steelmasters. The security of the Staffordshire firms has just been rudely disturbed by the exhibition in several of the localities in the Black Country of a section of a three-quarter-inch round bar of steel characterized by undisputed fibre. It is explained that it has been made by the granulating and balling-up of Siemens-Martin steel under a process which has been patented by Messrs. Dorman, Long & Company, and Mr. R. Howson, of the Middlesbrough-on-Tees. If by-and-by this "fibrous steel" should be shown by experience to be equal to the service of cable and rivet making, the best iron firms will be run very hard, since it will be impossible for them to compete with the steelmasters in the matter of price. The makers hold that the new metal is well adapted also for armor-plates — in the manufacture of which the pile has to return to the fire so often — since the silicious coating of each fibre protects it, it is claimed, from the action of the fire, where pure iron would perish. For the same reason it might be used, it is inferred, for the bilges of ships, as to which recent experience has shown that homogeneous steel is subjected to rapid oxidation. — *Iron*

CURIOUS EFFECT OF ARCTIC COLD. — A person who has never been in the polar regions can probably have no idea of what cold really is; but by reading the terrible experiences of arctic travellers in that icy region some notion can be formed of the extreme cold that prevails there. When we have the temperature down to zero out-of-doors we think it bitterly cold, and if our houses were not as warm as, at least, 60 degrees above zero, we should begin to talk of freezing to death. Think, then, of living where the thermometer goes down to 35 degrees *below* zero in the house in spite of the stove. Of course, in such a case the fur garments are piled on until a man looks like a great bundle of skins. Dr. Moss, of the English polar expedition of 1875 and 1876, among other odd things, tells of the effect of cold on a wax candle

which he burned there. The temperature was 35 degrees below zero, and the doctor must have been considerably discouraged when, upon looking at his candle, he discovered that the flame had all it could do to keep warm. It was so cold that the flame could not melt all the wax of the candle, but was forced to eat its way down the candle, leaving a sort of skeleton of the candle standing. There was heat enough, however, to melt oddly-shaped holes in the thin walls of wax, and the result was a beautiful lace-like cylinder of white, with a tongue of yellow flame burning inside it and sending out into the darkness many streaks of light. This is not only a curious effect of extreme cold, but it shows how difficult it must be to find anything like warmth in a place where even fire itself almost gets cold. The wonder is that any man can have the courage to willingly return to such a bitter region after having once got safely away from it, and yet the truth is that the spirit of adventure is so strong in some men that it is the very hardship and danger which attract them. — *Exchange.*

AN AMERICAN TO BUY CHAMBORD. — There is a surprising rumor extant about Chambord. It is that the famous château and its grounds are to become the property of an American millionaire. It will be necessary to have a special law passed to accomplish this, but it is said that a majority of the Chamber has already been secured for it. The Republicans favor it because they are anxious to make money and to get rid of all possible relics of monarchy. The Bonapartists favor it, of course, because of the hostility between them and the Bourbons. The Orleanists, also, are not disinclined to see such a law, because Chambord is the shrine of the elder branch, toward which they have no especially kindly feelings. So it is probable that Chambord will be sold, and will become once more the scene of life and gayety under the revivifying influence of American millions. It is now more than one hundred years since it has been occupied by its owners. It was built by Francis I, and was for many generations the favorite home of the Kings of France. There are few more splendid palaces in the world, and its situation, by contrast, adds attractiveness to it, for it stands on the border of the dreary waste of La Sologne. The late Comte de Chambord never occupied this royal home, though, of course, it was recognized to be his personal property. Dying, he left it to his wife, with directions that on her death, which has since occurred, it should become the joint inheritance of her two nephews — the Duc de Parma and the Comte de Bardi; the former to enjoy three-fourths and the latter one-fourth of it. These two Italian princes, therefore, are now the owners of this splendid property. This has caused great dissatisfaction, even among the adherents of the Comte de Chambord. The feeling is that he ought to have left it to the Comte de Paris, or else to the French people. So there will be no serious opposition and little regret at its sale to an American, especially since this would certainly restore the ancient glories of the place.— *Chicago Tribune.*

THE STORY OF TWO DESERTED WESTERN VILLAGES. — A correspondent of the *New York Tribune* tells the following instructive tales: While journeying to Chicago from New York recently the express train passed a group of buildings, some twenty in number, that attracted my attention. They were situated in a ravine far up a mountain slope through which a small stream wound its way, to swell in a few days or weeks the current of some mighty river. They wore the appearance of utter desolation that quickly overtakes the habitation of man when man has departed. But in this case man himself had assisted the elements in dismantling these former homes. Doors, window-sashes and everything easily movable had been carried away. All this was taken in at a glance as the train sped by, and in an instant the cause was revealed. Across the stream stood what had once been a saw-mill, but the saws, the machinery, and even the water-wheel had disappeared. It was needless to ask explanations. This village on the mountain side had been created for a purpose; it had served the end of its creation, and had been permitted to go to decay. Probably the timber, such as had been used in the mill, had been exhausted within available distance, and all that was worth removing of the old mill and houses had been carried to some new field of operation. As I pursued my way I thought of the desolate spot on the mountains and drew a mental picture of the scene, with the cottages filled with life and activity, children playing about the doors and the old mill in operation, its insatiable maw supplied from dawn to dark with food, by a score of hardy woodsmen.

In exploring the wonders of Chicago, this marvellous giant of the West, I had forgotten this little woodland picture, when suddenly it was recalled to me. I had visited one of the pretty suburban villages on the lake side, and had driven with a friend a few miles into the interior, when we came upon another deserted village. Streets had been laid out upon the prairie, but they showed the mark of the plough and scraper rather than of travel. Some twelve or fifteen houses stood in different stages of dilapidation or incompleteness; it required more than a casual glance to decide which. Some were without roof; some had boards over them, but no shingles, while others showed only the frames. The most complete building was the village store with its porch in front for the idlers of the town. Its windows and doors were boarded up, and, though benches were on the porch there were no idlers to use them. Long grass grew close to the foundations of the houses, and there was no sign of human inhabitants or visitors. This scene did not tell its own story, and I turned for an explanation to my friend, who readily gave it. He is a sedate, indeed, rather a solemn young man, and I don't think the following story was invented by him to gull an Easterner.

"Perhaps you know," he said, "that a few years ago Chicago ran wild over suburban village sites. Values of land in some of the older towns within easy reach by rail had increased in a greater ratio than in Chicago itself, and everybody who had money to invest or who wanted to live in a cottage out of the smoke of the city began to search for low-price building lots on the line of some railroad. Soon advertisements began to appear of lots for sale in the new and flourishing village of ——. Maps were exhibited by the agent of the company owning the unsold lots, and finally in the completeness of time the public was invited to visit the beautiful spot on a specified day. An excursion train was provided, made up of Pullman cars, free for all, and an expensive banquet was to be served in the new village.

"An inspiring scene met the view of the arriving party. All was bustle and activity. Huge piles of lumber were heaped up in all directions, and scores of workmen were busy with spade, saw, hammer and chisel. Here foundation sills were being laid, there heavy posts and beams were forced into place by brawny arms, and over yonder the click of the hammer and the sound of the saw was heard as boards, clapboards and shingles were securely fastened. Every workman labored with his might. It was evident that the future occupants of these cottages were impatient for their completion and spared no expense. There was no doubt of the prosperity of this new suburb; there could be none. Before the banquet had been digested and the train had returned to Chicago nearly every man who had gone out with any purpose of buying a lot had done so, and had paid the price, or a part of it to bind the bargain.

"The next day there were only enough laborers in the new village to gather up the tools and to ship the unused lumber to the yards from which it had been hired. No sound of industry has been heard there since that time. It was a good day's work for the men of the company who had bought a tract of worthless land for a song. You see, these old shells didn't cost much."

TRADE SURVEYS

WITHIN the past month or two a great deal has been said in a quiet way among manufacturers and in commercial channels as to the probability of over-production. There is very little to be gained by discussing such a question. The very fact that the question is under consideration is an encouraging one. In past periods of prosperity manufacturing and railroad-building interests seemed to entirely forget that a day of reckoning was ahead. The characteristic of our activity for eighteen months past has been that an eye was kept constantly upon the future. The results already achieved are satisfactory. We are making haste slowly. Makers of wood-working machinery in eight or ten different States have recently expressed opinions and given results concerning the first six months' business. They show that this industry is fifteen to twenty per cent ahead of last year. Some of the heaviest manufacturers of machinery and engines have recently reported that, counting the contracts now in hand for summer and fall execution, they are almost twenty-five per cent ahead of last year. There is a great activity in all machinery establishments East and West. A large number of new, but small concerns have started this year beyond the Mississippi. The railroads have started the demand. Foundries and shops are multiplying very rapidly. Four, and possibly five new and large railroad towns are springing up. These are some of the evidences of the prosperity which underlies the present activity. A score of others could easily be named. The locomotive-builders in the New England and Middle States have now the equivalent of three months' work ahead. The builders of small locomotive engines are busier than ever. Mine and lumber machinery, engines, etc., are in active demand. The makers of saw-mill and planing-mill machinery have several weeks' work in hand, and new manufacturers of such machinery are starting up with an abundance of work. A multitude of new industries are taking root. Nearly all of them are being planted upon a cash basis. The borrowed money is borrowed from parties directly interested. Large blocks of capital have been offered in the West from Eastern centres during the past four or five weeks. An attempt will be made to put Eastern capital on a more advantageous footing in the West. There is less dependence on it than heretofore, but plans are now under consideration by which large amounts of idle Eastern capital can be permanently employed in a multitude of avenues.

Our latest advices from Chicago, St. Louis, Kansas City and Omaha show that there is practically no falling off in building activity. Lumber shipments from Michigan and Chicago to Western points are remarkably heavy. Railroad-builders have very large contracts out for ties. New machine-shops are under construction, and railway-managers intimate that during the winter the machine-shop capacity of all Western roads will be very largely increased. Facilities for increasing rolling-stock in the West will shortly be established, not far from St. Louis and Chicago. A similar activity is in progress in the Southern States, the details of which are sufficiently familiar to the public. Nearly all of the industrial enterprises there are paying well. But for the scarcity of coke the production of iron would be heavier. The production of iron throughout the country for the first half of this year has been but little in excess of the first half of last year. This shows that there is a conservative management in the iron trade which proposes to avoid the much talked-of evil of over-production. As frequently observed heretofore, the car-wheel, car-axle and car builders are remarkably busy; and it is the determination of nearly all of the larger railroad corporations in the United States to supply themselves fully with rolling-stock; which determination means that the supplying interests will be kept busy for a year. This activity reflects itself in the lumber trade. New lumber yards are springing up West and South, and while the price of lumber to large consumers has not advanced it is creeping up on small buyers. The distribution of lumber throughout the Eastern cities is heavy, but prices keep surprisingly low. Yellow pine is arriving in large quantities at all Atlantic ports, and there is an abundant supply of hard woods for car, house and church requirements. The peculiarity of this heavy demand for all kinds of staple products is that prices are kept at a level. As to the future of railroad building, it can be said that during 1888 the activity will be as great as at this time. Railroad-builders will invest their money, not merely for the traffic returns, but for the advantages growing out of the appreciation in adjoining territory. Steel rails could be sold in very large blocks for winter delivery if makers would accept $37; average quotations are $38 to $39. The demand for all kinds of plate, tank and shell iron is very heavy, and mills which were idle in June are now sold three months ahead. The demand for structural shapes is extremely active, and it is no easy matter now to place an order for delivery within sixty days. The productive-capacity of the American iron makers is now twenty per cent ahead of last year. Furnace capacity is being increased, and mills are being improved and extended. In the department of textile industry manufacturers, especially of all grades of cotton goods, are encouraged to their utmost efforts by heavy orders. The paper-makers of the country will consider the subject of shutting down mills from Saturday evening to Monday morning in order to preserve the present healthy trade conditions. The manufacturers of electrical appliances have, since the 1st of July, booked orders which some of the heavy makers guess to be double the amount of business secured during any previous month.



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CONTENTS

WE have been asked to say something about the competition for the soldiers' monument in Indianapolis, which is to be decided in December next. The programme of conditions for competitors is not yet ready, so that we do not feel the disinclination to meddle in the matter with which we regard competitions in which the programme has once been published, and cannot, therefore, be changed without a violation of the contract made with persons who have accepted the conditions; and, moreover, the President and Secretary of the Commissioners show, in their letter to us, such an earnest desire to get a real work of art with the large appropriation made by the State, and so sincere a disposition to treat fairly and courteously the persons who accept their invitation, that, although we believe that they are to be sadly disappointed, we can do no less than explain our reasons for thinking so.

THE preliminary circular sent out by the Commissioners, although it contains only an outline of the conditions offered to competitors, shows plainly that some, at least, of the terms on which the State proposes to invite designs are such as no architect of reputation is likely to accept. The limit of cost is placed at the very liberal sum of two hundred and twenty thousand dollars, which, expended under the care of a first-rate artist, might secure for Indianapolis one of the noblest monuments in the world — a work which would attract strangers from long distances, and give the city a name throughout all civilization. In accomplishing this result, however, the first-rate artist is indispensable. From a second-rate man nothing but second-rate work of this kind can ever come, though he should toil day and night till doomsday; and from the cheap man, the enterprising person, the clever politician, the genteel lobbyist, or the rest of the crew that hustle each other after public employment, Indianapolis will get, instead of a work of art, an object which will appear every year more stupid and ridiculous, and will in some degree deaden and degrade the perceptions of all who look at it. It ought not to be necessary to insist upon this point, which every one comprehends who can see the difference between a statue and a tobacconist's image, and one would suppose that the people of the State of Indiana, in providing for the greatest work of art which will probably ever be erected there by public money, would have made sure of the employment of at least a tolerable second-rate artist by offering, as some compensation for the risk and expense of scrambling for the commission, the assurance that the best scrambler should be employed at the rate of pay usually accepted in civilized countries. This would be, for work of the kind, ten per cent on the cost, or twenty-two thousand dollars for designing and superintending the erection of the monument, with extra allowance for travelling expenses. First-class men, who do not need to scramble after jobs, would not be in the least attracted by the offer of this amount, or even of a much larger one, but it would be possible to excite even their interest by arranging the competition so that they might have the prospect of professional honor before them. He is a poor artist who does not like sometimes to measure his strength with his fellows, and to do his best to win the applause of men whose opinion he respects and values, and friendly emulation will lead men of artistic temperament to efforts which no offer of money would induce them to make.

THE Commissioners say that they "wish to imbue the work with the dignity of true art," and under such circumstances, although the best way to get what they wish would undoubtedly be to engage at once an architect and a sculptor of the highest reputation to make them the most beautiful monument which they were capable of doing for the money, the next best thing, in case they were hampered, as we suppose they were, by the common idea that the appearance of favoritism must be avoided by opening public work to all mankind, would have been to take great pains to make their competition a memorable event in the artistic world. It would have been well to offer a little more than the usual fee to the successful competitor, and the money could not have been better laid out; but much more important than this would have been the selection of a jury of the highest distinction. It would not have been necessary to multiply jurors; the decision of one man would be enough, but it is indispensable that he should be an architect or sculptor of world-wide reputation, such as Bartholdi, or Falguière, or Charles Garnier, or Ginain, among the French, or Alfred Waterhouse, or Norman Shaw, or a dozen others among the English. The idea of appearing before such men, of showing them what Americans can do, of profiting by their criticism, and, perhaps, of winning their applause, would be very attractive to our best artists, and if time enough were given them for the proper study of their design, many would, we venture to say, participate in the contest. We hoped, on reading the Commissioners' letter, that something of this sort was intended, but, although we learn that a good deal of discretion is given to the Commissioners in carrying out the affair, and therefore wish to speak with reserve, it must be acknowledged that the indications given in the preliminary circular point to anything but such a contest as we supposed. The most important matter is, of course, the composition of the jury, and we are told that this will consist of three members, an architect, a builder, and a civil engineer. That the Commissioners should wish to have an engineer represented on the jury is perhaps not unnatural, as there will be a certain amount of grading to be done about the structure, but the presence of a builder among the judges we cannot so easily account for. It is quite possible that the builders of Indiana may have had the advantage of artistic training, and are peculiarly sensitive to unity of design, silhouette, and breadth of modelling, but they are not so anywhere else, and their services in most places on a jury to consider a work of architecture and sculpture would be just as valuable as those of a frame-maker in judging of pictures. The third member is, indeed, to be an architect, and we do not doubt that the Commissioners will do their best to select a good one, but it is needless to say that not a single architect or sculptor, capable of doing the city of Indianapolis any real credit, will submit his work to the award of a jury so composed. We imagine that an invitation on the part of an agricultural society to the Western raisers of fancy live-stock to send their beautiful cattle and horses to be judged by a sailor, a sausage-maker and a farmer would not meet with much response, and it would not add to the attractiveness of the invitation to have it understood that all the animals, with the possible exception of one or two, would be killed on arrival, and the hoofs and horns only returned at the owners' expense. Indeed, to assimilate this agricultural competition to that presented to architects, as we read the preliminary circular, it would be necessary to announce that all the cattle and horses sent would be immediately confiscated by the management, but that if the interesting jury found good eating in any of them, it might possibly keep the remains and reward the owners by a "premium" of two dollars for the most toothsome specimen and one dollar for the next best.

THESE magnificent equivalents for a thorough-bred horse, or a Jersey cow, are pretty well proportioned to the rewards which the circular appears to offer to the architects who win the suffrages of the builder and the engineer, whether the architect on the jury agrees with them or not. As we read, a premium of one thousand dollars is offered for the best design, and one of five hundred for the next in merit; but nothing is said about employing the successful competitor at the usual Commission to carry out his design; on the contrary, it is expressly stipulated that the Commissioners reserve the right to reject all the designs, and that none are to receive premiums unless adopted. As it would be a poor set of competition drawings, and a still worse model, which did not cost the author at least a thousand dollars, it may be imagined how enthusiastically the members of the profession will rush to expend their hard-earned money on work for which they may possibly have a chance to receive back a portion of what the work cost them. With any architect of professional reputation it would be a very small portion. We have often known architects spend four or five thousand dollars on a set of competition drawings, and have known one thousand paid for a single pen-and-ink perspective, and five hundred for a very indifferent model, and, as architects' offices go, it would be impossible to give a design for such a building the necessary study, or to show it in creditable style, without spending far more than the amount of the highest premium; but the Indiana circular, not content with this, demands that competitors shall accompany their designs with minute and detailed bills of quantities, carried out with estimates. We presume that the authors of the circular do not know that the usual, and in England the legal compensation for making a bill of quantities from drawings, without estimates, is two-and-one-half per cent on the proposed cost, or, in this case, fifty-five hundred dollars for the quantities only, while the time and trouble required for making reliable estimates on anything so difficult as monumental work would be worth at least half as much more, or about eight thousand dollars for the proper and conscientious fulfilment of this condition alone. The Commissioners can judge how many reliable estimates they are likely to receive under these circumstances, or how valuable those are likely to be which they do receive, if any should be sent. Architects know well enough, if Commissioners do not, that bills of imaginary quantities, priced with a plausible approximation to correctness, form about the best means of getting building-committees into trouble that have yet been devised; and, in the hands of persons willing to deceive, give unlimited opportunity for successful fraud; yet under the Commissioners' circular nothing better can possibly be expected. They are likely, however, to be as good as the designs which accompany them; and, much as we would like to speak more favorably of an honest effort, we cannot see the least prospect that the invitation, unless radically modified, will bring, for the benefit of the great State of Indiana, anything better than a lot of compositions by stone-cutters' and granite-dealers' young men, with, perhaps, a few extraordinary efforts from recent pupils of the evening drawing-schools, accompanied by specifications of which the less said the better, and by quantities and estimates beneath contempt. It is impossible to believe that the people of Indiana really want professional service of that kind. They have appropriated a very large sum of money for a monument, and they cannot be willing to have it used to make them ridiculous. If they really think that they can get a man of skill and reputation to do what they propose for a thousand dollars, it is quite time they were undeceived. The work is well worth twenty-two thousand, without the quantities and estimates, which, if required, should properly cost eight thousand more, or thirty thousand in all. This is what would be paid to an architect by any city in Europe or America where artistic skill is held in honor, and very few architects grow rich, even with a succession of such commissions. It is quite possible to procure for a thousand dollars a diagram indicating a certain disposition of material, and at this price to reward richly the skill and thought employed in making the diagram; but two hundred thousand dollars' worth of material to a thousand dollars' worth of brains is not a proportion that has ever evolved artistic success, and the people of Indiana may rest assured that if, for every dollars' worth of stone they use, they pay ten cents to a man of first-rate skill for prescribing its shape and position, they will get what they profess to want as cheaply as it can be afforded.

IT is a long time now since the announcement was made that a competition would be held for the memorial to General Grant, to be decided next October, but the announcement was coupled with the explanation that the terms of the competition had not been fully decided upon, but would be published later. Up to this time the terms have not appeared, and, as this, from the interest of the subject, and the magnificent situation of the monument, ought to be one of the most interesting competitions of the century, it seems to us that the Committee should be reminded that the period remaining before the time for handing in the designs is far too short for a satisfactory result. Even if a man with no other work to do were to begin his design at once, he would have to hurry his drawings, and neglect the best parts of his design, to be ready in time; while for most architects of reputation, who are always busy, and must arrange long beforehand to have any given work taken up in its turn, it would be utterly impossible to get a creditable set of drawings, or a model, completed by October. It would be a misfortune to have the results of the scheme frustrated, after so long a delay, by the insufficiency of the time given to those on whom the success and renown of the monument entirely depend, and we earnestly hope that, before the circular of instructions is issued, the time will be extended at least three months longer. The participants in the famous Victor Emmanuel competition were given more than a year to study their designs; and this is none too long for the gradual process of selection and accretion by which a great and original design is developed in the mind. There is no fear that General Grant will be forgotten in twelve months; and not only the merit of the design, but the interest of the public in the competition, would be greatly promoted by allowing that period for its preparation. Something may be done in the meantime to promote the brilliancy and success of the contest. Following the excellent example set in other cases, photographs of the site of the monument from various points might, and should, be sent to all bona-fide competitors; and a short printed sketch of General Grant's life and great public services might with advantage be used to refresh their memory and stimulate their imagination. Much may also be done by a collation of the best monuments in the world, and in this we shall be glad to help, if the terms of the competition prove, as we trust they will be, such as the profession in all civilized countries has publicly approved.

DINGLER'S JOURNAL, one of the best of all technical periodicals, published not long ago an article on the influence of earthy sand in cement, which has attracted a great deal of attention, and has been widely copied. The immediate occasion of the writing of the article seems to have been the experience of the author with the concrete floor of a certain distillery. The floor was laid with what appeared to be an excellent concrete, made with one part Portland cement of the highest quality to three parts of sand. To make the concrete as hard as possible, it was carefully sprinkled every day. At the end of the month, it was still soft, and the proprietor called in scientific advice. Tests were made of the cement and sand; and the latter was found to contain four and three-tenths per cent of earthy particles, apparently marsh mud. A series of experiments was then made, by making trial briquettes of cement mixed with pure sand, and with sand containing more or less earthy matter; and, when placed under water in the usual manner, the latter were found to remain soft indefinitely. Most architects and engineers know that dirty sand is unfit for mortar or concrete, and know also how to test its cleanness, but the matter has not yet received the careful examination that it deserves. Not only vegetable mould, but clay, when mixed in small proportion with sand, will destroy the quality of mortar or cement, and even concrete of good quality is said to be injured, or "killed," by laying it on a clayey foundation; but no one, so far as we are aware, can say just how much clay in sand will prevent the setting of cement, or how far the influence of a clay substratum will extend into concrete laid upon it; or whether Portland or Rosendale cement is more injuriously affected, or how, in the many places where it is almost impossible to obtain sand that is not clayey or loamy, good mortar or concrete can be made. Architects and builders are in the way of looking to the engineers for the scientific examination of such subjects, and we should be very glad if that profession would undertake the task, for its own benefit as well as ours.

EARLY SETTLER MEMORIALS.[1]—XI.

ROBERT E. LAUNITZ.



THE first and only personality entitled to any consideration from an art point of view, that has appeared in the history of monumental art in the United States was Robert E. Launitz, of New York. His full name, as given by his family, was Baron Robert Ebrehardt Schmidt, von der Launitz. He was born in Riga, Courland, Russia, November 4, 1806.

Tradition explains the addition of Launitz to the original name of Schmidt as follows: In some early-age campaign of the Russian army a section of the Imperial Guard arrived at a little hamlet on the bank of the river Launitz in pressing need of a horse-shoer. A *schmidt* was fortunately found, and he performed his task so well that he then and there received the affix of von der Launitz to his first name, and was taken into the service of the army as a recognition of his skill and character. The subsequent careers of the descendants of the horse-shoer amply justified these marks of royal appreciation.

Of Launitz's immediate family there were six brothers. One was a Russian field-marshall and aid-de-camp of the emperor; two were generals; another succeeded his father as bishop, and the only one now living is also a general. One of his uncles was the late eminent and learned sculptor, Carl v. d. Launitz, of Frankfort-on-the-Maine, and another was a general in the Russian army.

Launitz received an excellent classical and military education, and was intended by his family for a soldier, but his natural tendencies were artistic, and, following the advice of his uncle, the sculptor, who was then practising his profession in Rome, the young Robert went to that city and began his studies with his uncle, and finished them with Thorwaldsen.

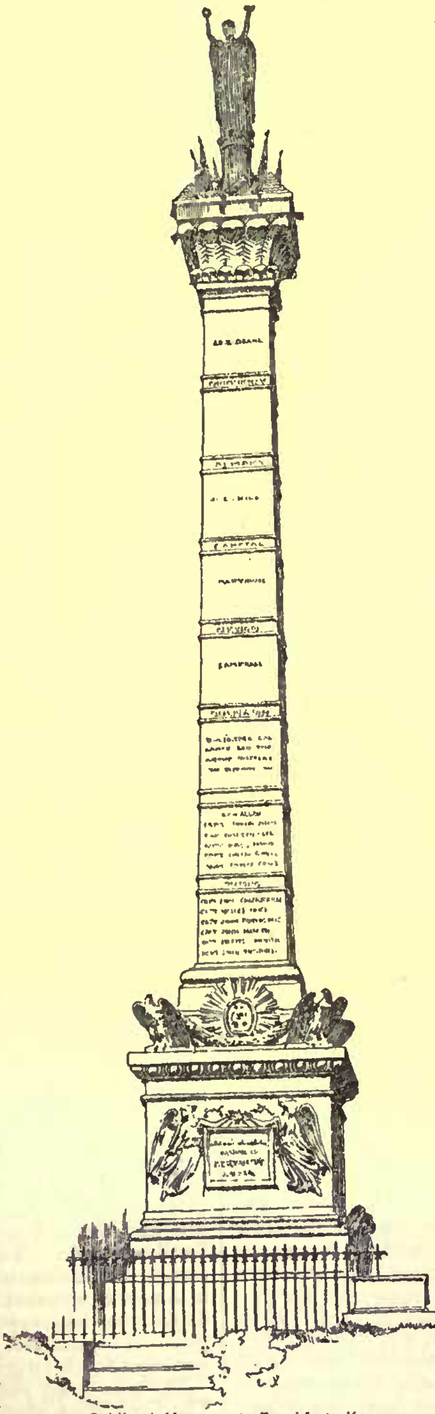
What tempted him to leave the old world for the new we do not know, but he arrived in New York City in 1828, unable to speak a word of English, though thoroughly conversant with the Russian, Italian, French, German and Spanish, and quite familiar with several other languages and dialects. Besides, he had lost his hearing in Rome as the result of a fever, was unknown to a living soul when he landed, and the prospect of gaining a livelihood by the exercise of any of his talents or acquirements could not have been much more dreary if he had gone to Alaska.

At this time John Frazee, afterwards known as an able maker of busts, and the designer and builder of the New York Custom-House, was carrying on the marble business in New York. To him Launitz wended his way, was employed as a journeyman, and remained in his employ until 1831, when the two formed a partnership, and Launitz's name first appeared in the directory as a sculptor, at 591 Broadway. When Frazee received the commission to build the Custom-House in 1837, Launitz assumed entire control of their business, remaining at the old stand until 1844, when he removed to 536 Broadway, and occupied the lot afterwards built upon by the great jewelry house of Ball, Black & Company. During the first ten years of his life in New York Launitz was not, as it may be imagined, very successful. Marble work in those days was confined almost entirely to small grave-stones, plain memorial-tablets, mantel-pieces, and occasionally a trifling piece of carving. He was at times so closely pressed for the bare means of subsistence that he was obliged to cut and turn little fancy objects in alabaster for immediate sale. A curious instance of the perversity of human nature, and an illustration of the flimsy foundation upon which a large structure of pretense was constructed, occurred during these years. Ball Hughes, a young English sculptor of very conventional ability, also arrived in New York in 1828, and shortly after received a commission from some admirers of Alexander Hamilton to make a marble statue of the great statesman. When his plaster model was ready to be reproduced in marble he refused to employ Frazee or Launitz to execute it, asserting as a reason that there were no men outside of England sufficiently capable of properly executing such an important work. He therefore sent to England and imported several workmen who subsequently became, as well as some of their sons, journeymen to Launitz. Not only were both Frazee and Launitz far abler men than Hughes in all that pertained to marble work, but they were quite as good modellers.



Monument in Greenwood Cemetery. R. E. Launitz, Sculptor.

At the same time there was in Boston Solomon Willard, as able and competent a worker of stone, granite, and marble as ever swung a mallet in this country. Frazee, Launitz, and Willard served their day and generation with a skill, intelligence, and loyalty unequalled then, not since excelled, and in these later days rarely, if ever, approached.



Soldiers' Monument, Frankfort, Ky. R. E. Launitz, Sculptor.

Now and then a ripple of public interest was caused in New York by the appearance of some small piece of sculpture, from the studio of the talented Russian, heightened more or less by the sad or stirring history connected with the subject of the work. For instance, there came to Washington and the Atlantic cities, in these years, a delegation of Sac and Iowa Indians, on a visit of business and curiosity. A sachem of the former tribe was accompanied by his daughter, Dohumme, a beautiful maiden of sixteen summers. In the same delegation was a youthful Iowa chief. These children of the forest became attached to each other, loved, and were married with Indian rites at Paterson, N. J. The new couple were handsome and graceful, and attracted universal attention after their arrival in New York. Amid scenes and exposures, so unlike those to which she had been accustomed in her forest home, Dohumme caught a violent cold, followed by congestion, and death soon closed the scene. She was buried in Greenwood Cemetery, and a simple monument, decorated with a bas-relief, representing a grief-stricken Indian warrior, was executed by Launitz, and erected over her grave.

The literary circles of New York were excited in those days from time to time by the poetic eccentricities of the "Mad Poet," McDonald Clark. An oft-repeated and characteristic expression of his is as follows: "Now evening lets her curtain down, And pins it with a star." When death came he, too, was carried to Greenwood, and laid to rest near the grave of Dohumme. His monument is ornamented by a medallion portrait of himself, by Launitz. In this way Launitz became known in New York as an accomplished modeller and worker in marble, but still more as a cultured gentleman of enviable character and acquirements.

But it was not until 1845 that he received a commission of any considerable importance. This was for the statue of Miss Charlotte Canda. The circumstances which brought it into existence were so sad, the monument of which it formed a part was so elaborate and unusual at that time, and the fact that a statue in pure white marble was to be made, representing the beautiful and unfortunate lady herself, created a public interest in the sculptor that we can hardly appreciate at the present moment. Then, to make a statue, meant a great deal. Now, in the truthful words of a professor of painting in one of the largest colleges of the country, "any one can make a statue."

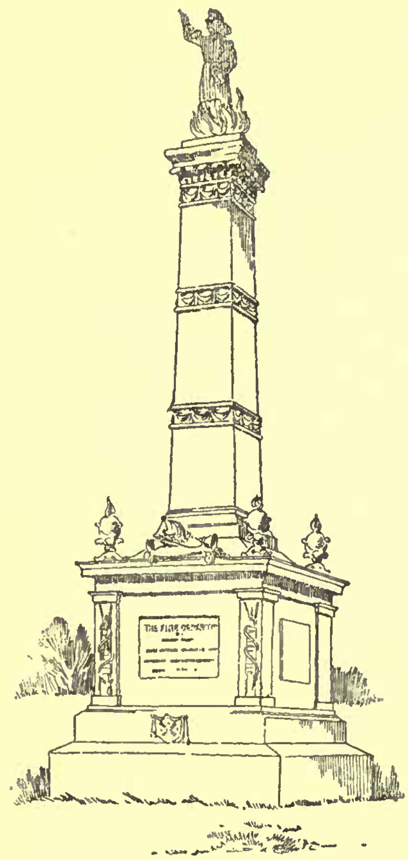
While returning from the festive enjoyments of a party of friends on the evening of her seventeenth birthday, February 3, 1845, Miss Canda was thrown from her carriage and almost instantly killed. Such an event, under any circumstances, is deeply impressive. How especially so when one who possessed the rarest accomplishments and the most extraordinary

[1] Continued from page 268, No. 597.

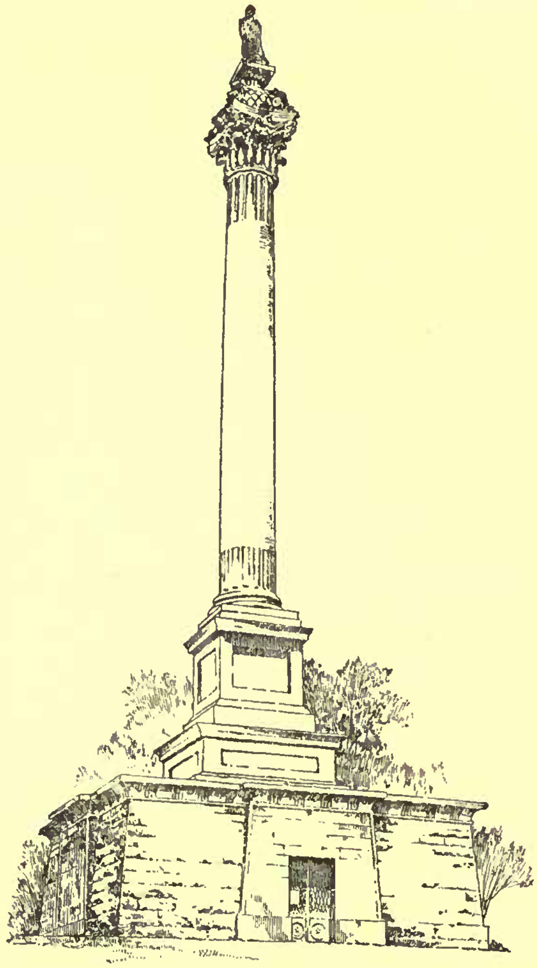
natural gifts is cut off in the freshness of youth. Such a one was Miss Canda.

The idea of the monument, in its general outline and essential features was designed by Miss Canda herself, and was intended as a tribute to a beloved aunt, whose death occurred a few months before her own, and who now sleeps at her side. The entire work was executed from drawings made by Mr. Canda. It is safe to say that no private memorial since erected in the United States has aroused so much pathetic interest and curiosity. Of the millions of people that have visited Greenwood, where it is erected, during the past forty years, not one has failed to gaze with feeling admiration upon this expression of loving remembrance. The execution of the statue carried the name of the sculptor throughout the length and breadth of the land.

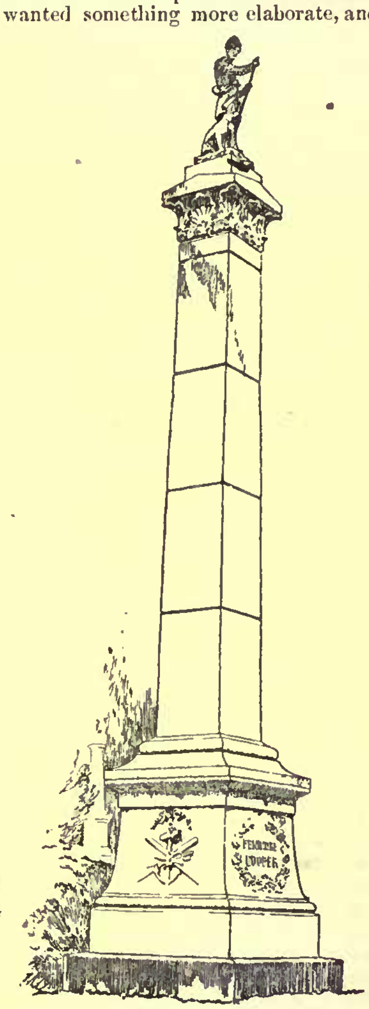
Soon after its completion the New York Fire-Department gave Launitz an order to design and execute a marble monument to the memory of the firemen of that city who had lost their lives in the discharge of their duty. It was the first large monument erected in a cemetery in the United States, and the first one that paid tribute to an element of general human sympathy. The monument is surmounted by the figure of a fireman in the very act of saving a child from the devouring flames that have already partly surrounded them. Its erection created a wider public interest, if such a thing were possible, than the Canda monument. The two made Greenwood a Mecca for a generation, and New York City the headquarters for fine monumental work, until the breaking out of the Civil War.



Fireman's Monument, Greenwood Cemetery.
R. E. Launitz, Sculptor.



Monument to Henry Clay, Lexington, Ky.
Built by John Haly



Monument to James Fennimore Cooper, Cooperstown, N. Y. R. E. Launitz, Sculptor.

In those days there were many excellent marble-cutters, even in the smaller towns and most retired hamlets. Men who worked at their trades with a genuine intelligence and sincerity, and who regarded the execution of a fine monument as a matter of personal pride and public interest: a matter to be thought of in company with other important public acts of a representative character. The superiority of weight of material over skill had not reached their simple minds, and a surface of polished granite made by a common laborer had not superseded the work of the chisel. Hundreds of these men, employers and workmen, saved their money for the purpose of going to Greenwood to see these monuments. This was especially true of the time when the World's Fair was open in New York. The fame and name of the wondrous foreigner was on all their tongues, and many of them sought out his shop for the purpose of seeing him. The sextons of cemeteries were particularly and pridefully interested, for they all hoped that some day or other they could boast that their grounds were also adorned with some specimen of his cunning workmanship. Truly enough, these hopes were gratified to a surprising extent, for before Launitz took his place in the silent city, he had erected one or more of his monuments in nearly every large cemetery in the country, and was well known and warmly loved by their guardians. Among these appreciative admirers and oftentimes very interesting characters was an old Scotchman by the name of Carmichael who kept the grass green and the flowers in bloom over the ashes of those whom he had laid to rest in the beautiful cemetery of Frankfort, Ky., and when the Legislature of that paternal State decided in 1848 "to erect a monument to those who had fallen in the defense of their country," he hastened to tell the committee on the monument that a man in New York, by the name of Launitz, was the one they ought to employ to do the work. Fortunately the committee was composed of men who had a good monument in view, and Judge Mason Brown was chairman. He was delegated to go to New York and contract for such a structure as he thought best. The history of the contract, in the words of Launitz, is as follows: "Work had been slack for several years — though others had plenty to do — and I was on the point of giving up business and going to work as a journeyman in order to support my family, when there came into the shop one day a modest-appearing gentleman who said that he would like to look at some designs for a monument. I showed him some plain ones that I had on hand, but he said that he wanted something more elaborate, and asked me if I would make him some sketches to show him when he would call the next day. As I was pretty nearly discouraged I did not think much of this desire for sketches, but I thought I would make one more effort before giving up completely. I therefore made a design that would cost $7,000 — a large sum in those days to expend for a monument. When my client returned the next day he objected to the design because it was not large or costly enough. My breath almost left my body in astonishment, and I looked at him with surprise. I actually thought the man was crazy. I was, however, able to say, 'My dear sir, if you will be good enough to tell me what you want this monument for, and how much you wish to pay for it, I will try again.' To my still greater astonishment he quietly observed that he wanted the best war monument that could be made in America, and that the price was immaterial. I at once made a design that he accepted, and I agreed to make and erect it for $15,000. This man was Judge Mason Brown, of Frankfort, a representative Southern gentleman, and ever after my good friend."

The monument was erected in 1850, and cost its maker $17,500. The Legislature offered to pay Launitz the additional $2,500, but he refused to accept it because he had agreed to do the work for the first-named sum. It stands in the centre of the State cemetery at Frankfort, Ky., and in a locality appropriately called "The Bivouac of the Dead," for around it in concentric rows sleep the brave hearts

that have beat their lives out in battle for their country. It is sixty-two feet high, built of Italian marble, and surmounted by the Goddess of War holding in her outstretched hands the wreaths of victory. It is inscribed with the names of those who fell in the early Indian, the 1812, and the Mexican wars, the names of the battles in which they participated, and is dedicated as follows: "Kentucky has erected this column in gratitude equally to her officers and soldiers."

Near it are monuments to the memory of many of Kentucky's most distinguished sons, early settlers and later makers of her fame. Under its very shadow lies the body of the author of that deathless elegy, "The Bivouac of the Dead," Major Theodore O'Hara. The poem was written, it is thought probable, in the cemetery in 1847. No finer tribute was ever paid by poet heart to soldier dead. This is the first verse:

"The muffled drum's sad roll has beat
The soldier's last tattoo;
No more on life's parade shall meet
The brave and daring few.
On fame's eternal camping-ground
Their silent tents are spread,
And glory guards with solemn rouud
The bivouac of the dead."

And this, the last:

"Yon marble minstrel's voiceful stone
In deathless songs shall tell,
When many a vanished age hath flown,
The story how he fell:
Nor wreck, nor change, or winter's blight,
Nor Time's remorseless doom,
Shall dim one ray of holy light
That gilds your glorious tomb."

O'Hara died in 1867, and was buried in Georgia, but in 1874 the Kentucky Legislature, ever jealous of the possession of the ashes of her sons, brought all that was mortal of the poet to Frankfort, and together with the remains of two governors and several distinguished officers of the Mexican War, reinterred them in the State cemetery. There the soldier-poet sleeps his last sleep by the side of his old comrades, and amid the scenes consecrated by his genius.

As we write, the newspapers inform us that the remains of Hart, Kentucky's sculptor, who died in Florence, Italy, have been recently brought from that city, by a Commissioner of the State, and also interred in the State cemetery.

In the classic virtue of love for the dead, as displayed by Kentucky, she stands quite alone of all the States of the Union. The ashes of her sons are her sacred inheritance, and their fame her crown of glory. The resolutions passed by the Legislatures in reference to the erection of memorials to their memory are models of grateful and noble appreciation of private worth and public bravery. They read like the expressions of domestic affection, and they were carried out, so far as the monuments made by Launitz are concerned, with an intelligence and loyalty that excite surprise in the later days of monumental jobbery.

The State cemetery probably contains as many examples of the varied styles of Launitz's monument as any other in the country, with the exception of Greenwood. In view of these facts it seems astonishing that this State could set up such a pile, to such a man, as the Clay monument at Lexington, and at a cost of $77,000. And this, too, in seven short years after the war monument consecrated the soil of the State. The Clay monument is one hundred and thirty-two feet high. Its erection illustrates the old and unpleasant fact of how small an influence a good piece of work has upon a community. The Washington Column in Baltimore had been completed nearly thirty years, yet the lessons it might teach to builders of similar structures did not reach Kentucky, and as far as known they have not left the municipal boundaries of Baltimore.

This human fatality of bad monuments following in the wake of good ones, attended Launitz throughout his whole life with a persistency that has never been equalled. Within half a stone's throw of this Fireman's Monument stands as wretched an object as ever desecrated a grave-yard. It was set up soon after Launitz erected his work, and the persons who made it, and those who paid for it were as well satisfied with its ugliness as they would have been with a Phidian masterpiece. Another fatality of a still worse nature also followed Launitz. No sooner did he erect a specimen of his beautiful workmanship than a miserable imitation of it would soon follow. Greenwood is full of such imitations. One successful monument-maker made it his special business to copy the designs of Launitz, underbid him in price and execute the work in an inferior manner. Shameful to say, he succeeded in this scheme of debasement.

T. H. BARTLETT.

CORONATION-CHAIR EXPLANATIONS. — Mr. Plunket, replying to Sir Thomas Esmonde in the House of Commons on the evening of July 4, said: "It is true that certain missing portions of the Coronation Chair in the Abbey were, for the purposes of the recent ceremony, of necessity replaced by new work, but this was very carefully arranged, so that they could be again removed without any damage to the chair, and they have been so removed. It is true also, that a considerable portion of the chair was slightly darkened. That, too, was done so as to be easily capable of being undone, and the chair is now, both as to substance and color, exactly as it was before it was given into my charge. I am so fortunate as to be able to state that the Dean of Westminster and the President of the Society of Antiquaries are well satisfied with the careful manner in which the monuments and the structure of the Abbey have been treated by the Office of Works. — *Pall Mall Gazette.*

HINTS FOR BUILDERS.[1]—III.

MORTARS AND CEMENTS.


A Gateway. Bruges.

PASSING on from bricks, brick-making and brick-laying with which my last chapter was concerned, I come now to a consideration of that which holds or binds them together, and which, in some instances, notably that of the old Romans, was in reality far stronger and more permanent than the stones which it was originally designed to bond together.

Although this chapter has to do primarily with mortars and cements, I shall have to dwell a little longer upon that portion of the bricklayer's work which is more intimately associated with the division under notice.

Thus all bricks, when placed in the hands of the layer, have about them certain peculiarities and imperfections, more or less marked, which must be dealt with according to the nature of the work in hand and the respective merits of each brick. One of these peculiarities is the "frog," which is a sinking purposely formed in one side of the brick, being found in stocks, pressed and the majority of hand-made bricks. The proper way to lay a brick having a frog is to keep this side uppermost — the top bed, the flat side being known as the bottom bed. This frog very much facilitates the bedding of the bricks, in placing each succeeding layer or course, on account of its affording room for the surplus mortar, which would otherwise have to be exuded from the edges at the sides. Never lay bricks with the frogs downwards, as the mortar not being in the cavity a hollow space is created, and consequently the weight of the mass is thrown upon the edges of the courses instead of being spread evenly and uniformly over the whole of each brick, and in the case of large walls or arches it is very likely that the bricks will burst, and break or "spall" off in large flakes when the bricks are so wrongly laid, this being particularly the case when the bed is at all fine. I may mention that the frog is a comparatively modern invention, none of the old bricks having it.

Another peculiarity in the greater number of bricks, particularly hand-made brick — the machinery of late years remedying this defect — is that they are bevel-headed; that is to say, out of square at the ends — the top edge overhanging the bottom, and more so at one end than the other, the defect arising during manufacture while the bricks are plastic. Stocks as a rule are more often affected thus than any other description of brick, and this fault causes much inconvenience to the brick-layer, especially in forming angles, the difficulty being got over, so far as possible, by regulating the bed accordingly.

I come now to the joints formed by the layers of mortar between the bricks, the horizontal layers being known as the bed-joints, and the vertical layers as the cross-joints, which again in fair-faced work are called "perpends." The usual way in England to determine the thickness of the bed-joints is, at the beginning of the work, to take four of the bricks from the stock of those selected with which to carry out the job, set them up one upon the other, then measure the height, and add $1\frac{1}{4}$ inch for the four joints — thus, as an example, say the four bricks measured $10\frac{3}{4}$ inches, add $1\frac{1}{4}$ inch for the joints, which consequently makes 1 foot for every four courses — this being the guage. A rod should be provided, with the courses marked upon it accordingly — this being the guage rod. Of course the guages can be differently struck, but the above serves as a good sample from which to work. Bricks without a frog will require a higher gauge, as frog-made bricks are capable of a closer joint than those made without a frog. It is a great mistake to build brickwork with large joints, both pecuniarily and otherwise, as the larger the joints the greater the settlement. Also in the erection of all new brick buildings, care should be taken to avoid so far as possible, the carrying up of one portion to any considerable height before another, on account of the risk of unequal settlement.

To sum up this portion of my subject, I may say, in conclusion, that a good brick should be uniform in size; standard 9 inches by $4\frac{1}{2}$ inches by $2\frac{1}{2}$ inches — (the sizes vary somewhat in different descriptions, as I have pointed out) — weight about 7 lb.=110 lb. per foot cube; is rectangular, true-faced, but only one end and one side need be smooth, has no print sinking on either face, but a hollow on one or both beds. When saturated with water a brick should not absorb more than 20 per cent of its own weight of water, should absorb it reluctantly, and part with it freely at ordinary temperature. It should be uniformly burnt, should be sound, free from cracks, flaws, stones, lumps of any kind, but particularly pieces of lime (whether red, yellow or white), should have a metallic ring when a couple of bricks are struck together; and when broken should be sound right through, should be tough and pasty in texture, and not granular, and should require repeated blows to break it instead of one hard blow.

Mortar is a substance consisting essentially of lime and silicious sand, the lime being in the state of hydrate, employed for the purpose of cementing stones and bricks together. The sand employed is

[1] Continued from page 271, No. 597.

of different degrees of fineness, from the finest river or pit sand up to the coarsest gravel, the latter, when mixed with lime or water, forming concrete. When the lime which is used for the manufacture of mortar has been taken from a limestone containing clay, or argillaceous matter, the mortar possesses the quality of setting under water; then the lime is termed hydraulic lime and the mortar made therefrom, hydraulic mortar. Such mortars which, are also termed cements, are also prepared in conjunction with lime, from certain volcanic productions, such as *pozzuolana*, and *trass*, besides certain products of artificial calcination. As, however, the basis of all cements or mortars is lime, I shall deal first with the carbonates of lime. Pure carbonate of lime is found in calcareous spar and a few other minerals, but the majority of the calcareous rocks contain other ingredients besides carbonic acid and oxide of calcium, these ingredients being magnesia, oxide of iron, manganese, clay, bitumen, quartzose sand, etc. The term limestone is applied to those stones which contain at least one-half their weight of carbonate of lime; and accordingly as the other ingredients may prevail, a limestone may be argillaceous, magnesian, sandy, ferruginous, bituminous, etc.; these varieties being still further distinguished, according to their forms and texture, as laminar, saccharoid, granular, compact, oölitic, chalky, etc. The limes obtained from one or other of these stones vary in quality, color, weight, hardness except when manufactured into mortar. Lime is prepared from limestone by the action of heat in kilns, arranged so as to deprive the limestone of its carbonic acid as completely as possible in the shortest time, with the smallest quantity of fuel and the least amount of labor. The action of lime when slacked with water is very different with the various kinds, and this action establishes certain important differences between them. Imagine, as an example, the lime is fresh, and is immersed in water for five or six seconds, the water being then run off and the lime turned into an earthenware vessel. The action will then be as follows:

1. The lime hisses, crackles, swells, gives off much hot vapor, and then immediately falls into powder.

2. The lime remains inactive for some time, generally not more than five minutes, when the appearances described above under 1, may become actively developed.

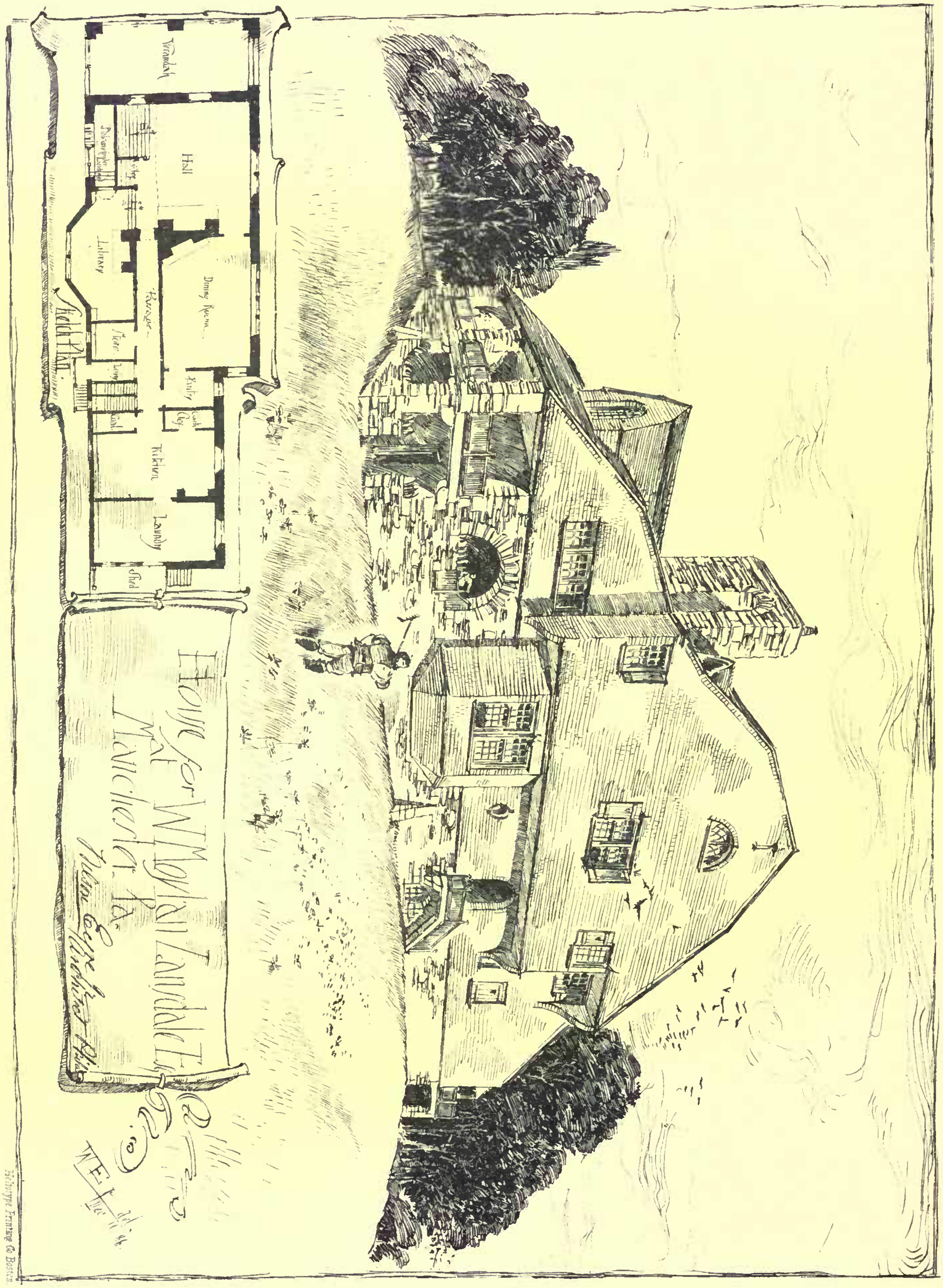
3. The lime may remain inactive from five to fifteen minutes, when it will begin to smoke and crumble, though the heat and vapor will not be so great as in the preceding phenomena.

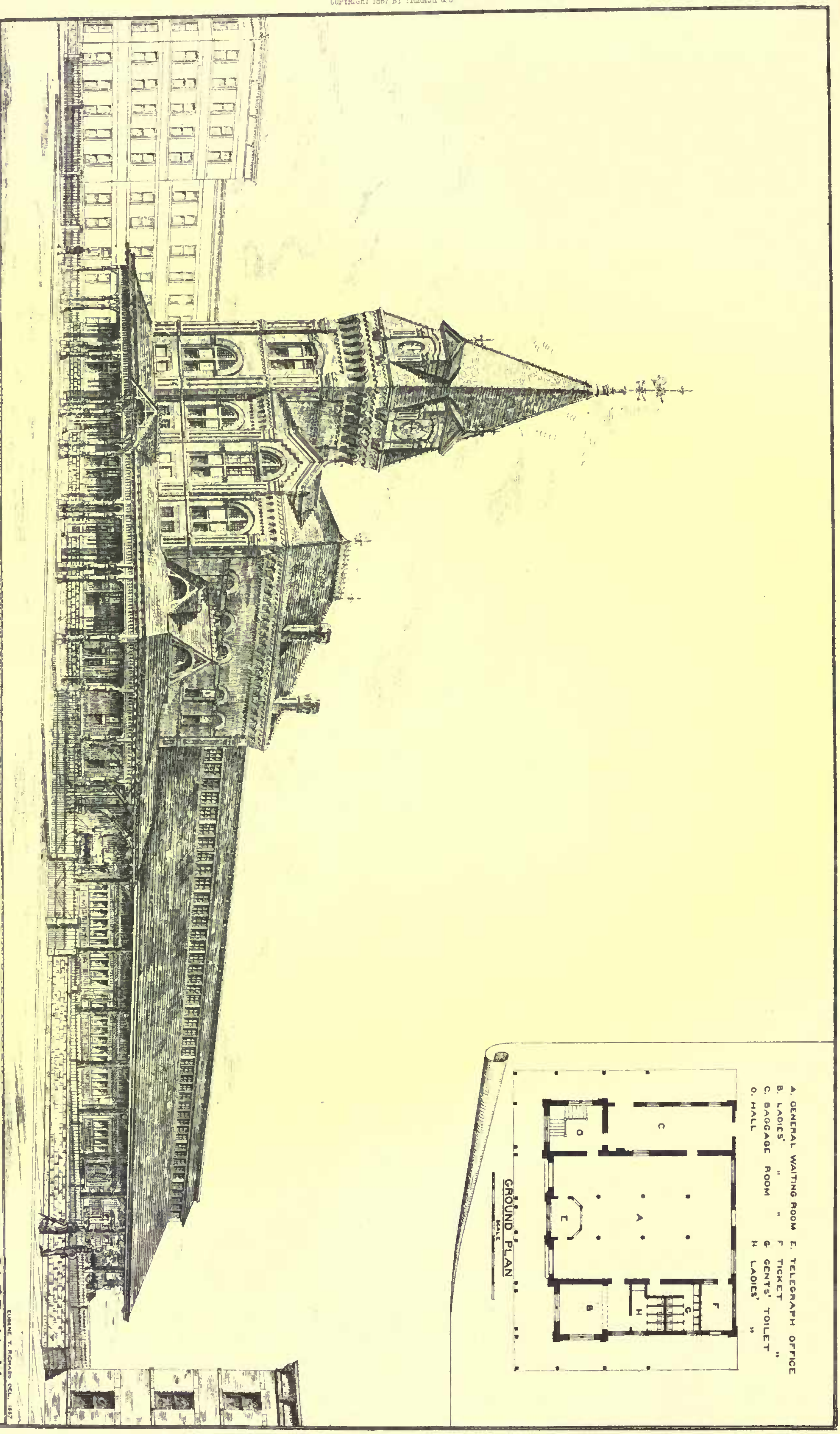
4. The lime may remain passive for a long time — over an hour even — when it will crack without any noise, and very little heat or steam will be produced.

5. The above phenomena are produced at different times, and are scarcely perceptible. The heat is only evident to the touch, the lime does not fall at all readily into powder, and at times not at all. Before the effervescent action has quite departed, the slacking of the lime should be finished. When the lime begins to crack, water should be poured down the sides of the vessel containing the lime so as to fall to the bottom and there be absorbed by the lime. It must then be frequently stirred, and a sufficiency of water added so as to bring it into a thick consistent paste. Then leave it to cool, which will generally occupy from two to four hours. It must then be beaten up again, adding more water if necessary, until the mixture forms into a thick paste as before. An earthenware vessel should then be filled with this paste and the whole placed under water, and the duration of the immersion carefully noted, as owing to the results thus obtained can limes be divided into five classes thus, — 1, rich or fat; 2, poor; 3, moderate hydraulic; 4, hydraulic; 5, highly hydraulic. The first of these consists of pure or very nearly pure oxide of calcium, and the purer the carbonate of lime from which they are produced, the more decided the appearances during slacking. These limes increase in volume to double their original bulk, their consistency does not alter, and if exposed to pure water, frequently renewed, they would be entirely dissolved. The second of the limes on being slacked only increases in bulk to a very trifling extent. They will not set under water, but will be dissolved by it, except a small residuum. The third limes will set in from 15 to 20 days' immersion, and continue to harden for months. They change in bulk in slacking very slightly, and dissolve with difficulty in water frequently renewed. The fourth description of limes will harden generally in from six to eight days after immersion, and so continue to harden for six months. In a year they are of the consistence of soft-building stones, and water has no further action on them. Their change in slacking is very slight. The last mentioned set in from three to four days after immersion, become quite hard in a month, and are not affected by running water, while in six months they can be worked similarly to the harder natural limestones, which they much resemble in fracture. Their change in bulk is slight while slacking.

I shall not enter into the chemical composition of all these limes, as this would serve no very useful purpose, and beside would occupy much valuable space. Suppose a rich lime to be mixed into a thick paste, and then left for some time exposed to the air, it will gradually dry up, and there will then remain a friable mass of hydrate of lime. If, however, a thin layer of this paste be interposed between a couple of smoothly-dressed porous stones the greater part of the water in the paste will be absorbed in the stones, and the thin layer of hydrate of lime sets and adheres strongly to the stones. The absorption of the water must not be too quick, or the hydrate will set too quickly, and in that case will not become hard, therefore the two surfaces of the stone should be wetted before the lime is applied, and also, as the adhesion between the hydrate and the stone is greater than that between the particles of the lime, the layer of the latter between the stones should be very thin and evenly spread. A much better and firmer substance, however, is procured by mixing with slaked lime twice its weight of quartzose sand, or any similar material, powdered, and then mixing and stirring the whole well up with water. This mixture must then be spread by means of the trowel over the surface of the nether stone, and the other stone placed evenly upon it, when the excess of mortar is pressed out, and only a thin layer left. In this instance, each grain of sand is enveloped in a covering of the lime, which prevents the mortar from contracting, and subsequent fissures. The proper setting of the mortar does not depend upon the evaporation of the water only, but also upon the combination of the lime with the carbonic acid of the air. Those parts of the lime which come into contact with the air become converted into carbonate of lime, but the interior parts form a combination of carbonate and hydrate of extreme hardness. A great length of time is, however, necessary for this state to be attained, for after many years the lime will still exist as a hydrate, and consequently mortar made with it should never be employed in thick walls where it cannot possibly dry. Rich lime mortar should never be employed for outside brickwork for the reasons which have been pointed out above — namely, unequal drying, as if so used, it will exude on the first frost and then dry friable. If so used, a large quantity of sand should be intermixed to prevent excessive shrinkage, but, generally speaking, it should only be used for plastering and sanitary purposes. An advantage with it is that it can be worked again and again without injury, and consequently large quantities can be made at one time, without any loss.

Having dealt thus fully with lime and its principal constituents and qualities, I come now to a brief consideration of the subject of cement. Fifty years ago the principal cement in general use for building purposes was the well-known, but now almost forgotten, Roman cement, or, as it was very often called on account of its dark-brown color, black cement. It was of a very quick-setting nature calling for very careful treatment. It was in quality very varied, that being the best which was slowest in setting. It would not bear a large proportion of sand, and was only extensively employed in waterside works. Another cement, very quick in setting, is the Medina cement, but as it is difficult to use in brickwork, it is not necessary to touch upon it further here. Among the other natural cements are, in England, Harwich, Calderwood, and Whitby, which are mostly employed for plastering, as they possess no great strength, and will not stand the weather. I come now to the artificial cements, the principal among which is the well-known Portland, which is manufactured by an intimate admixture of chalk and clay, the proportions being varied according to the composition of the chalk, the object being to get a mixture possessing about seventy per cent of chalk to thirty per cent of clay. These are mixed together in water, and run into tanks called backs, where the mixture remains till it becomes nearly solid. It is then dug out, dried, burnt, and finally ground to powder, this process being known as the wet one. The dry process is generally adopted where limestones are used in lieu of chalk, the stones being crushed by machinery and the clay burnt like ballast, the two being then mixed in suitable proportions and ground to powder. This is next thoroughly mixed in a pug-mill and made into bricks, when these again are burnt, dried and ground to powder, which completes the process. This is the more tedious method, and there is a great difference in the quality, caused principally by unequal burning, and great care has to be exercised in selecting the cement-clinkers for future grinding into powder. Portland cement is the strongest and most valuable of all the artificial cements, but it takes longer to set than any of the other descriptions. In works of any importance the quality of Portland cement is tested in a variety of ways — its weight per bushel, the degree of fineness to which it has been ground, its tensile strength, its color, its behavior both in and out of water, and its quickness in setting. The *weight* varies from ninety-five pounds to one hundred and thirty pounds per bushel, the measure being filled as lightly as possible, and struck level on the top. This is not a good test, as, first, it is not possible to fill all bushels alike; secondly, a lightly-ground cement will not weigh so much as a coarse-grained one; and thirdly, there are many light cements of first-rate quality, and many heavy cements which are really worthless. The heavy sorts set slowly, and possess greater strength than the lighter kinds. The *fineness of grit* is a very good and important test, and should consequently be carefully attended to, as this finely-ground cement, when mixed with sand, makes the strongest mortar. The fineness can always be tested by rubbing between the fingers, also, by passing through a fine sieve, the smallest employed having 2,500 meshes to the square inch. For ordinary purposes the sand should pass through a sieve of 900 meshes. The *tensile strength* is not of very great importance for ordinary building purposes, but in engineering works the reverse is the case. Testing-machines are employed for getting the strength, the cement being formed into small "briquettes" and immersed in water for six or seven days, when they are placed in the machine and called on to sustain 400 pounds pressure to the square inch without fracture. In *color* good Portland cement should be of a good gray, darkness denoting too much clay or too heavily burned. Usually, a light color and a light weight cement denote a quick setter, but a bad cement may also be of a good color. In *setting*, good Portland cement sets more slowly than any other, the time depending on the quality, the best setting slower and attaining greater strength than the commoner

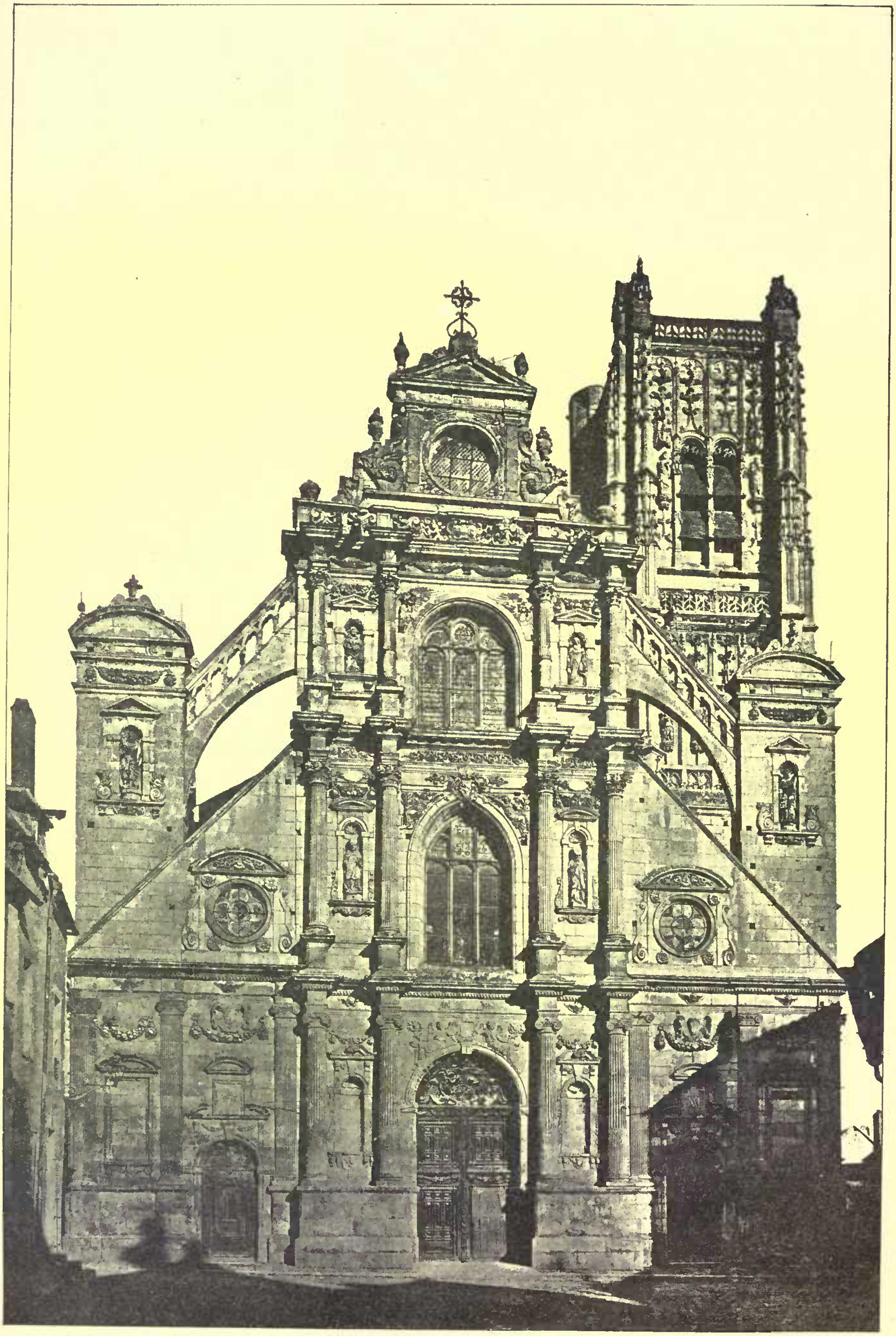

Verandah
Hall
Library
Dining Room
Kitchen
Laundry
Shed
Sketch Plan



PERSPECTIVE VIEW OF PASSENGER STATION FOR THE NEW YORK LAKE ERIE & WESTERN RAILROAD CO. AT ROCHESTER N. Y.

OFFICE OF THE ENGINEER OF BRIDGES AND BUILDINGS C. W. BUCHHOLZ CHIEF ENGINEER GEO. E. ARCHER ARCHITECT

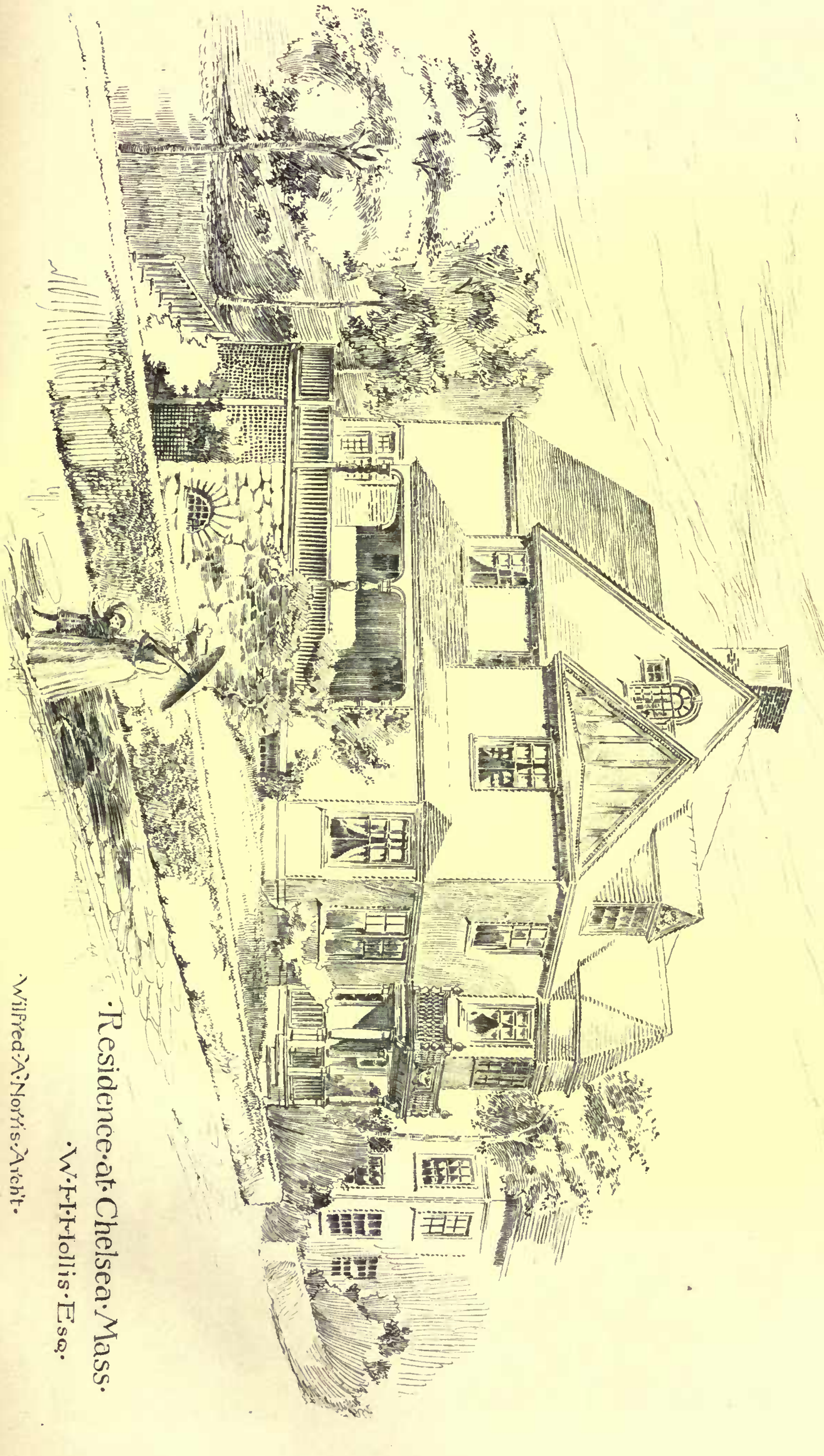
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Heliotype Printing Co. Boston.

Church of S. Pierre, Auxerre, France.

American Architect and Building News, Aug. 6 1887. No. 606



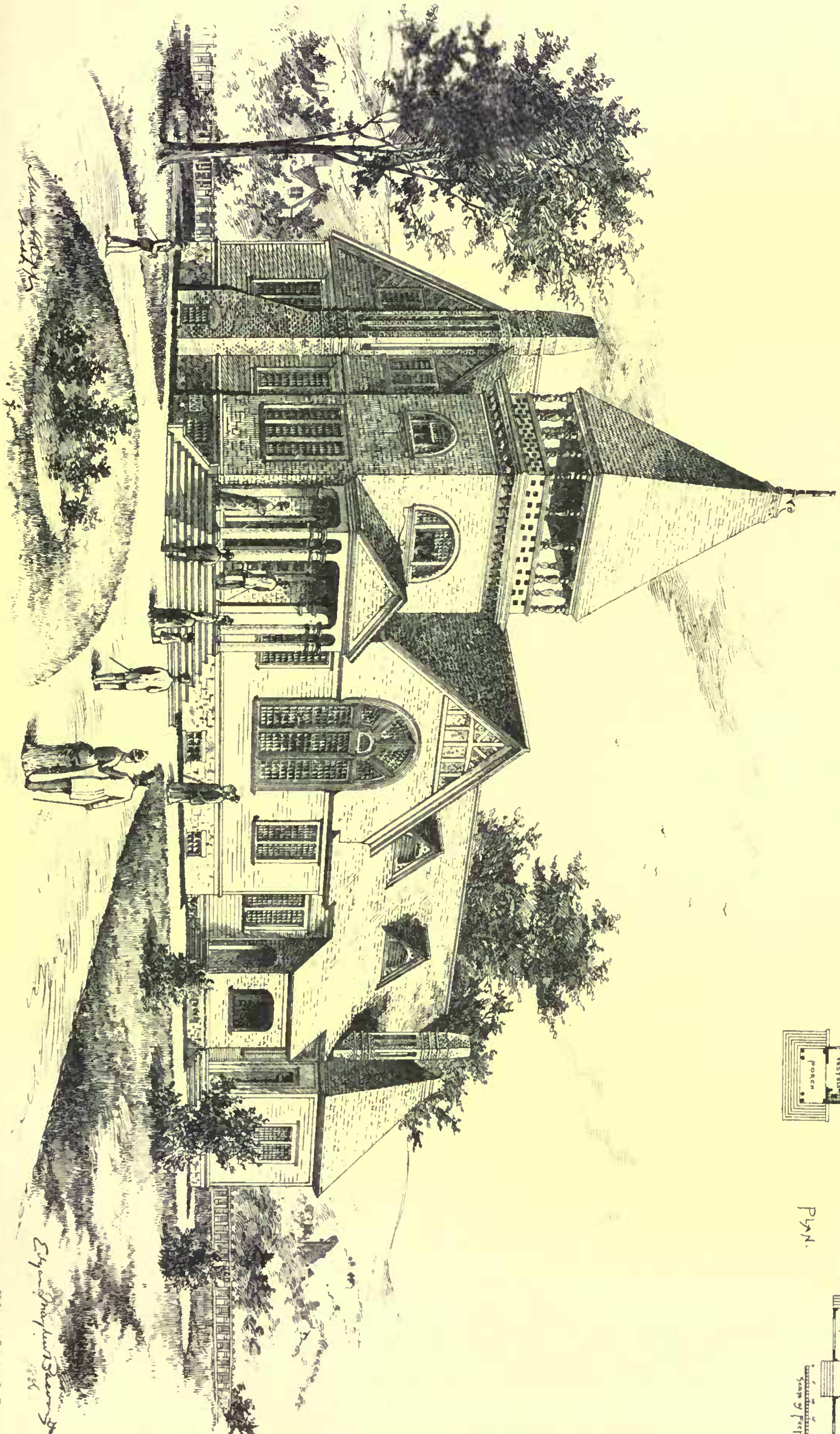
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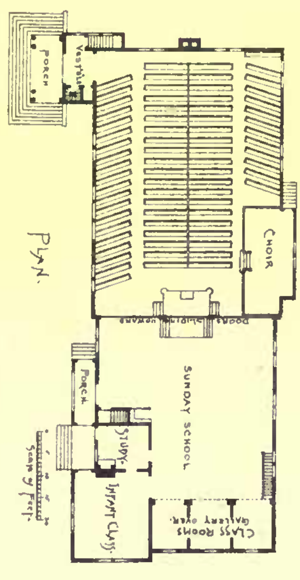
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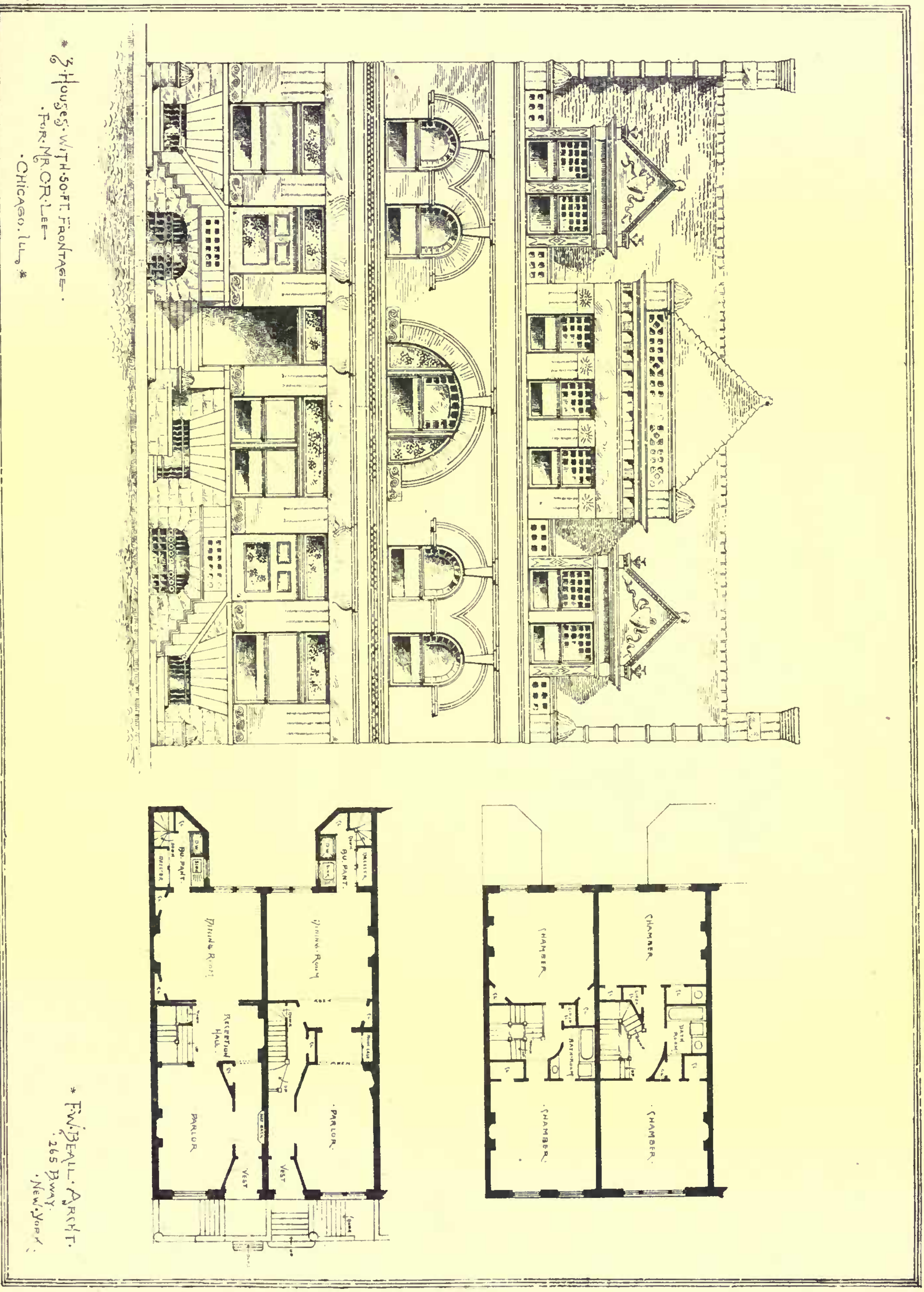
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Heliotype Printing Co. Boston

Puritan Cong'l Church
Wilkes-Barre, Pa.
Albert H. Kipp, Arch't
Wilkes-Barre, Pa.







Heliotype Printing Co. Boston.

descriptions. The usual plan of testing the setting quality is to make small pats about one-half inch thick and three inches across, thin at the edges, with neat cement; one is placed under water as soon as it has set, and another is left in air and then left for twenty-four hours, when they are examined. The one placed in water should show no signs of cracking at the edges, cracks denoting too much lime; the one left in the air should retain its original form and color; if it contains too much clay it will have a yellowish appearance. Care must be exercised in testing the pats not to use too much water or too little, as either will make the cement defective, and quick-setting cements require more water than slow-setting ones. These pats should set in from three to six hours. Portland cement should always be turned out from the bags in which it is received onto a wooden floor in a room protected from the weather, and in the course of a month turned over several times so as to become air-slaked thoroughly, and when in perfect condition should feel just warm. It must be used as soon as mixed — in this way resembling plaster-of-Paris — and must never be reworked after it has commenced to set.

I have dwelt thus at length upon Portland cement, on account of its importance; I shall now pass on to a brief note on the Keene's, Parian, and Martin's cements. The first named is made by soaking plaster-of-Paris in a solution of alum, and recalcining it. The cream-color, which is sometimes given to it, is caused by adding a little copperas to the mixture. It is manufactured in two qualities, the coarse and the superfine. Parian cement is got by mixing powdered plaster-of-Paris with a strong solution of borax; it is then recalcined, ground, and mixed with a solution of alum. In Martin's cement the process of manufacture is similar to that of the preceding, carbonate of potash being employed instead of borax. It is made in three qualities — coarse, fine, and superfine. These cements are only used for indoor work — such as skirtings, angle-beads, mouldings, etc. — for which they are all admirably adapted.

To come now to mortar, I must remind my young readers that its quality depends very largely upon the manner in which it is prepared, and also upon the quality of the sand, the quantity of water with which the lime has been slaked, and the greater or less perfect mixture of the materials. The sand should be rough and sharp, and in all cases mortar should set slowly. The mortar for ordinary work consists of one part stone-lime to three of sand; the sand is made into the form of a basin or crater, into which the lime is thrown in a quick state; water is then added to slake it, and the whole covered up with sand; after remaining in this state until the whole of the lime is reduced to powder, it is worked up with the sand, and the whole passed through a wire screen, which separates the core or unslaked portion of the lime. Of course, this is the ordinary hand practice, such as would have to be adopted for small jobs, but for large undertakings the mortar making and mixing machine could be called into requisition where hand labor would be largely dispensed with. When the mixture has passed through the screen more water is added to it, and it is then thoroughly well larryed up for use. In a few hours it sets and is ready for use. Seventy-two bushels of good stone-lime and eighteen yards of sand, when formed into mortar, should have a cubical content of 315 feet. In dry places ordinary mortars made with rich lime take considerable time in solidifying, in moist places they solidify with difficulty, and under water not at all, hydraulic mortars being then employed. As mortar-mills and pug-mills are, I take it, tolerably well known to all of our readers, I shall not touch upon them here, but for the reason that men are sometimes called upon to do small jobs, I have thought it advisable to include the hand-mixing in my paper.

In my next chapter I shall treat of masonry and mason's work.

W. N. BROWN.

[To be continued.]

The ILLUSTRATIONS

[*Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.*]

THE CHAPEL OF THE LITTLE WELL, GUADALUPE, MEXICO.

[Gelatine Print, issued only with the Imperial Edition.]

THE Chapel of the Little Well (*La Capilla del Pocito*), is a perfect little gem, built in the year 1791. It consists of two circular buildings connected, the well or mineral spring which first gushed forth from the rocks upon the occasion of the Virgin's last visit, being in the smaller one, that first entered from the street. The other is a chapel. Its interior is not attractive. The circular walls are of stone, elaborately carved about the doorways and windows, and unfortunately painted a dark red where not carved, thus giving it a handsomer appearance in a picture than in reality. The domes are of glazed tiles in alternate zig-zag lines of dull yellow and dull blue.

HOUSES FOR C. R. LEE, ESQ., CHICAGO, ILL. MR. F. W. BEALL, ARCHITECT, NEW YORK, N. Y.

THESE houses are to be three story and basement, of Philadelphia pressed brick, with blue-stone trimmings, rock faced, laid up in red cement "of irregular sizes." There is an entrance to basement under front stoop, with a passageway partitioned off leading to kitchen in rear; front part of basement to be used as cellar, in which there will be furnace, coal-bins, etc. There will be a staircase leading from basement to first floor reception-hall, and another from kitchen to butler's pantry. Kitchen will be provided with range, two wash-tubs, sink, larger pantry, and closets. From vestibule which will be neatly tiled and tinted in dark colors we enter hall, in which there is recess for hat-rack. Entering from hall to parlor, which will be neatly finished in mahogany, with neat tiled mantel and hearth, separating parlor and dining-room, there is a reception-hall with broad fireplace and stairs broken by several landings. Hall and dining-room to be finished in old oak. Dining-room has closets, and connects with butler's pantry in which is a dumb-waiter, sink, dresser, closets, and stairway to kitchen.

Second floor to have two larger chambers with ample closets. Front chambers to connect with spacious bath-room, lighted overhead by skylight, to be ventilated at roof. Third floor to have three chambers, servants' and store rooms. Roof of end houses to have pitch of 60°, which will not be detrimental to shape or appearance of chamber. Each room to have neat wood mantel to correspond in color to rest of woodwork. Houses to be provided with gas, speaking-tubes to kitchen, etc.

PURITAN CONGREGATIONAL CHURCH, WILKES-BARRE, PA. MR. A. H. KIPP, ARCHITECT, WILKES-BARRE, PA.

THE cost is to be $8,500, complete except gas-fixtures.

PASSENGER STATION FOR THE NEW YORK, LAKE ERIE AND WESTERN R. R., ROCHESTER, N. Y. MR. GEORGE ARCHER, ARCHITECT. MR. C. W. BUCHOLZ, CHIEF ENGINEER.

HOUSE OF W. H. HOLLIS, ESQ., CHELSEA, MASS. MR. WILFRED A. NORRIS, ARCHITECT, BOSTON, MASS.

HOUSE FOR W. MOYLAN LANSDALE, ESQ., MANCHESTER, PA. MR. WILSON EYRE, JR., ARCHITECT, PHILADELPHIA, PA.

CHURCH OF ST. PIERRE, AUXERRE, FRANCE.

UNITED STATES GOVERNMENT BUILDING PRACTICE.[1] — VI.

BRICKWORK.



MAISON DE LA RUE DU JOUR-Lucarne
After LA CONSTRUCTION MODERNE

BRICKWORK, though not the most expensive, is by far the most important material used in building; first, because the great majority of structures entitled to the name of buildings are built of brick; and, secondly, because in buildings with stone and iron fronts, the general stability of the structures is dependent upon the brickwork, and the weights of the walls, floors and roof are most always carried by the brickwork, except where columns and piers are required, when these are frequently made of iron or stone.

As before stated in connection with stonework, except for small buildings the brickwork for walls is usually let in a contract separate from the other work in the building. The floor arching, paving, etc., is seldom included in the same contract with the walls, as it is not deemed advisable to have these classes of work executed until after the roof is completed and it would interfere with brick contractors, after the walls in their contract were completed, to wait several months for the roof, before finishing the arching and paving.

SPECIFICATION.

The contractor to furnish all the labor and materials, bricks, mortar, etc., and build complete all the brick masonry of walls as shown on the drawings and called for in the specification, including bedding and setting plates for ends of iron beams, girders, trusses, etc., and building-in all the iron and wood work of floors and roof, cramps, anchors, etc., that may be necessary, and which will be supplied by the Government.

On the plans and sections the portions of walls hatched in alternate broken and solid lines indicate bricks.

Common Brick. — Generally all unexposed exterior walls of building and areas, the backing of exterior walls, the foundations for steps and all interior walls and piers are built of common brick. All the common brick to be best quality, hard-burned, square-edged, sound, free from limestone, etc., and taken from the heart of the

[1] Continued from page 7, No. 601.

kiln; no bats, soft, salmon, or defective brick will be allowed to be used.

The common brickwork to be best quality, bonded every fifth course through the whole thickness of wall with headers thoroughly bedded and jointed in mortar, laid solid and as close to each other as the character of the brick will allow; the joints of each course of brick to be flushed full with mortar well worked in with the trowel, and also grouted with thin mortar in addition to the flushing.

Thickness of Walls.—As before stated, the brick walls of a building are made sufficiently thick to carry all the weights of the structure, and where stone or pressed-brick facing is used, it is not considered in determining the thickness of the brick backing; but the backing is made just as thick as the walls would be if constructed without the facing. The exterior walls, and interior bearing and partition walls are never made thinner than is required by the New York City building law (which may be conveniently found in "*Kidder's Architects' and Builders' Pocket-Book,*") but are generally made from 4″ to 8″ thicker. The backing of exterior walls is never made of less than two-and-a-half bricks (because it usually includes flues 8″ wide built one brick's length from inside face of wall, and at least one-half brick must be between the flue and outside facing of wall) except in the top story where sometimes a two-brick wall is sufficient. Interior walls sustaining floors and roof-trusses are made not less than one-and-a-half bricks (usually two bricks) thick and partition-walls are made one brick thick for upper story, one-and-a-half bricks thick for the two next stories, and one-half brick additional thickness added for each two lower stories.

Size of Piers.—Brick piers are used much more frequently than either stone or iron, both for interior work and in walls between openings where they are frequently overlooked as being really piers; yet the information and data concerning their strength and stability are very meagre and seldom definite: while many experiments have been made as to the crushing strength, etc., of bricks, yet the deductions therefrom seem not to have been put into such shape as to be of much practical use. Good brickwork laid in best cement mortar, which is always used by the Government, is generally calculated to sustain safely nine tons to the square foot (that is, a factor of six). This is assumed to be safe up to 10′ or 12′ high, increasing the size of the pier in accordance with its height; no pier over six feet high should be less than twelve inches square. Brick piers like wood and iron posts and columns are liable to break by bending as well as by crushing after they are built to a certain height; their strength decreasing in proportion to their height, but not uniformly.

The following table has been carefully calculated upon this basis by an experienced engineer, and has been used by him for years, but has never before been in print:

No. of times smallest diameter or width contained in height.	Safe weights per square foot in tons and tenths. Factor 5.	Safe weights per square foot in tons and tenths. Factor 4.
1	9.8	12.3
3	9.5	11.9
6	8.	10 0
9	6.3	7.9
12	4.8	6.
14	3.5	4.4
16	2.7	3.4
18	2.1	2.6
20	1.7	2.1
25	1.1	1.4
30	.8	1.

Interior Walls.—The interior walls not having concrete or stone footings to have quarter-brick offset for footings, with a double course at bottom; the interior brick piers to be square and plumb; the backing of area walls to have 2″ offsets as shown; and all brick backing to be properly bonded to stone facing.

All brick must be properly and thoroughly wetted immediately before being laid.

Trowel Pointing.—The exposed joints of brickwork in basement, ventilating and elevator shafts, and in attic rooms which are not to be plastered are to be neatly trowel pointed; all the remaining joints to be cut off rough for plastering directly on the brick.

Arches.—Arches in brickwork are usually built either segmental or semi-circular. Segmental arches are generally constructed to a radius equal to their span or width of opening.

Where extraordinary or uneven strains are to come upon arches, their strength should be carefully calculated; generally speaking, arches of four feet span and under are built of two-half brick rings; from 4′ to 8′ span in three half-brick rings, and over 8′ span in four half-brick rings. The edges of bricks at intrados of arch to be as near together as the character of the bricks will allow, and at extrados where the joints open on account of the radiation from centre to be well filled in with slate wedges or spawls, and filled perfectly full and flush with mortar.

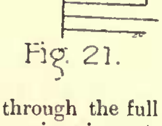


Fig. 21.

All brick arches throughout to have stone skewbacks, the height to be equal to the depth of the arch, and to be eight inches wide at top as per Fig. 21.

The arches of interior reveals of door and window openings in exterior walls, and openings in interior walls to be in two, three or four half-brick rings, as shown, properly bonded, and to extend through the full depth of reveal or thickness of wall; the arches over openings in vent-flues to be straight, 8″ deep; where several openings come together with small brick mullions, relieving-arches are to be built over each series of openings.

Centres.—The contractor to furnish the materials, cut, build, and properly set all the centres for the arched openings in brick walls, which must not be struck or eased until the mortar is thoroughly set. The centres of square-headed openings to be left in place for securing trim of doors and windows, to.

Air Inlets.—Under the window-sills where indicated on drawings, air inlets to be constructed as shown, the space under window-sills to be 1″ and the vertical space to be 2¼″ wide, and near the floor to have two low segment arches in one half-brick ring, the half-brick inner wall to be tied with brick withes and built up close to underside of sill.

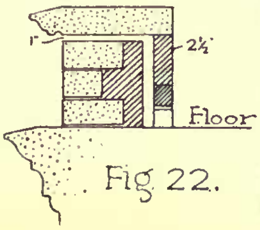


Fig. 22.

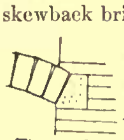
Flues.—Flues for ventilating purposes, smoke flues and chases for down-pipes and goose-neck connections, and for soil and heating pipes to be constructed where shown and of the dimensions noted, all to be built regular and true with selected fair brick. The backs of chases for piping to be plumb from bottom to top, and all chases to start at footings. Recesses for heating-pipes to commence 12″ below basement ceiling, and at head of openings ¼″ x 3″ flat iron to be built-in as a lintel.

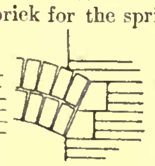
The smoke-flues to be lined with terra-cotta rectangular pipes, usually 8″ x 12″, which must be closely mitred at all angles and jointed and set in clear cement, the joints to be perfectly tight to prevent the smoke injuring the mortar in the brickwork should it come in contact with it; and where so noted on plans the smoke flues to be provided with soapstone thimbles 9″ x 9″ x 4″, with pipe holes 7″ in diameter, properly set in positions.

The heating and vent flues to be provided with No. 26 B. W. G. galvanized-iron flue linings, securely riveted at sides and at all joints and mitres, to be built-in with the brickwork and the brick built close against same; care to be taken to prevent mortar getting into the flues; proper elbows, connections and dampers to be provided for all register openings into same. The register faces and frames will be included in the heating contract.

Air-Spaces.—Air-spaces or cavities to be formed in the brickwork of exterior walls to be one brick's length from inside face of wall, to be generally 4″ wide (sometimes 2″), the inner wall to be tied to the outer with brick ties or withes built with ordinary bricks properly bonded and not more than 2′ distant on centres; the cavities to be entirely bricked over at least 1′ below all floor and ceiling joists and roof-rafters, so that the weights from same may be properly borne by both walls; the mortar joints in cavities to be neatly trowel pointed, care to be taken that no part of the cavities is filled by the falling of mortar; openings to be left at all points where chases, cavities, etc., are liable to become clogged with mortar and at completion to be cleaned out and the openings carefully bricked up. [Air-spaces are left in walls to prevent dampness coming through; it would undoubtedly make a stronger wall, keep out the dampness just as well, if not better, and be about as cheap, to omit this air-space, make the wall that much thinner, and face the inside of exterior walls with hollow terra-cotta furring blocks about 2″ thick, which should be thoroughly secured to walls.]

Skewback Courses.—The contractor to build-in purposely made skewback brick for the springing of brick arches of first-story floor and all vaults, the skewbacks for first floor to be single as per Fig. 23, and for all vaults to be double as per Fig. 24, the courses to be built on two sides of each room at the levels which will be given by the superintendent.


Fig. 23.


Fig. 24.

Corbelled Courses.—For supporting the terra-cotta arches of the upper stories, corbelled courses to be built on two sides of each room, etc., at level of bottom of iron beams as shown by Fig. 25.

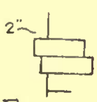


Fig. 25

Corbelled or projecting courses of brick to be also built and properly bonded on all walls where indicated on drawings for the plaster architraves and cornices of the rooms, corridors, etc., in the several stories, the number of courses and projection from face of walls, which will be about 2″ to be as shown by details to be furnished.

Hollow Bricks.—The hollow brick walls to be built with approved hollow partition-block properly bonded. Any good pattern made by the terra-cotta companies may be used for these partitions, but one constructed as per Fig. 26, is preferred; the blocks may be from 3″ to 8″ thick, hollow inside and the material of blocks and ties to be 1″ thick, every joint to be provided with an inside tie the outside of blocks to be roughly scored for plastering; the blocks and ties to be set in clear cement mortar with joints not over ¼″ wide.

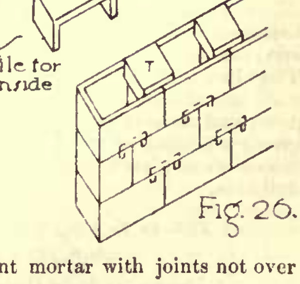


Fig. 26.

Setting Bed-Plates.—The Government will furnish all the bond-

stones, bearing-plates for beams, girders, trusses, columns, etc., and the bearing-plates required on top of iron girders for brick walls to rest upon [these plates may be slate, stone or iron, depending upon which is cheaper in the locality where needed], but the brick contractor to properly bed and set same in the required positions and levels, and will also be required to properly build-in all iron and wood work of floors and roof.

Where the beams of floors or roof are not on hand in time for the masonry, the contractor will be required to leave pockets in the brickwork sufficiently large for the beams, etc., to be slipped in place and proceed with the masonry in order that the work may not be delayed, and after the beams have been set will be required to brick up the pockets around same, solid.

Arrises, Bevels, etc. — The contractor to do all cutting of bevels, curves, skewbacks, etc., required; the arrises to be plumb, straight and true, and the faces of walls to be perfectly vertical and out of wind. The dimensions of walls, openings, flues, recesses, etc., to be as shown on the drawings.

Cramps and Anchors. — The contractor to build-in all the iron cramps, anchors, tie-rods, etc., that may be supplied, all to be thoroughly imbedded in mortar.

Joining Walls. — Where new work is joined to old, and where dwarf or other walls join onto main walls in which there would probably be much settlement in one wall and not in the other, straight and plumb channels are to be cut in the old work or formed in the new, not less than 4″ deep, by the brick contractor and the walls built and joined closely in the channel.

Shoring. — Where walls temporarily project beyond their supports, or any cutting out under walls is required, the contractor will be required to thoroughly and substantially shore up under these projections, and after these supports are in, to build up solidly under the walls.

Mortar. — The mortar for all the common brickwork to be best quality, two-thirds by measure of clean sharp sand, one-third by measure of freshly-ground cement (equal to the United States Government brand) and a quantity of stone-lime paste equal to one-third of the quantity of cement, all thoroughly mixed and used before the first set.

Building Walls. — The courses of brickwork to be kept perfectly level throughout, and the walls built uniformly; that is, one part of the building must not be built up more than about 4′ 6″ or a scaffold high before the remainder is brought to the same level, unless otherwise ordered by the superintendent.

The bricklayer must follow the stonework closely, backing up thereto and building the interior walls, etc., in proper consecutive order, and he will not be allowed to delay the setting of the stonework in any way.

Protection during Construction.—All projections, mouldings, angles, etc., of common pressed and moulded brickwork to be substantially protected by boards, etc., from injury during construction, and the tops of brick walls to be covered with boards to protect them from rain, etc., and, if considered necessary by the superintendent, to be covered whenever leaving off work; and should winter intervene before completing the work, great care to be taken to prevent water and frost getting into the walls, and the contractor must assume all responsibility for shutting-down work or for working too late into the winter season; the contractor to furnish all lumber, nails, tools, etc., and labor necessary for such protection and maintain same until completion of work.

Pressed and Moulded Brick. — Where brick is used for facing the walls of a building, all the walls above ground line (or water-table as the case may be), jambs and reveals of openings, inside walls of porches, walls of areas, dormers, chimneys and ventilating-shaft to be faced with pressed and moulded brick equal to the best Baltimore, Philadelphia, or St. Louis make.

All moulded and ornamental courses, projections for bands, imposts, hood-moulds, cornices, etc., to be red pressed and moulded brick of the various patterns shown by details, the numbers of which are taken from the catalogue of the Peerless Brick Company, of Philadelphia, Pa.; bidders, however, are not confined to this make of brick, but must adhere to the profiles and designs shown or indicated.

The pressed facing and moulded brick to be laid and properly bonded, the body of walls laid as stretchers and bonded to backing as often as the courses coincide, which should be at least every fifth course; the brick for skewbacks and arches to be purposely-made or gauged and rubbed to the required radii, and jointed and bonded as shown; all pressed and moulded brick to be laid and jointed in best quality lime putty (or pulp black or red mortar as designed) properly tempered, the joints to be fine ruled and not over ⅛″ wide. If necessary, special bricks to be used for all circular portions, made to the required curves.

All cutting and rubbing of the face and moulded brick must be nicely done and show a clean straight joint, no filling with putty and coloring it to match brick will be allowed.

The kind of bond between pressed and common brick is not usually specified, each contractor being allowed to use his particular system; sometimes the diagonal bond is called for, which is done by cutting away the rear corners of the pressed brick, thus leaving an unbroken front of stretchers, and laying the common brick diagonally into these corners, as per Fig. 27; sometimes the Flemish bond is called for, which is a single course of brick headers and stretchers, alternating and laid every fifth or sixth course.

Terra-cotta Trimmings.—All moulded and ornamental work which cannot be easily executed in brick — pilaster bases and caps, keystones, terminals of hood-moulds, panels, spandrels, finials, etc.—and which are usually indicated on the drawings, to be best quality red terra-cotta, in strict accordance with the full-size details and models which will be furnished by the Government to the successful bidder. All to be moulded evenly and perfectly burned, clean, out of wind, and of the designs and dimensions shown, and free from imperfect edges, cracks and all defects. All the terra-cotta to be bedded and set in the same kind of mortar as the pressed brick; to be properly anchored where necessary with galvanized-iron cramps, ties, etc., in best manner, which must be supplied and built in by the contractor.

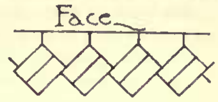


Fig 27

Selected brick should be treated in the same manner as pressed brick, except that it may be made to look very nice with joints ¼″ thick in red mortar or black.

Enamelled brick is seldom used except for handsome halls and vestibules; it should be treated as pressed brick; the mortar to be best lime putty tempered with plaster-of-Paris and colored to match the enamel.

Projecting Courses. — Projections for pressed and moulded brick should not be more than 2″ or 3″ for each course, the total projection of a series of courses or corbels should not exceed 18″, and wherever the projection exceeds 6″ beyond face of wall above, it should have a capping of stone, slate or metal; the stone or slate capping should extend from extreme edge of projection to from 4″ to 8″ under the wall above same; where metal is used for cap-flashing, it should be copper or galvanized iron, eighteen ounces per square foot, well bedded on top of projection in cement; have the outer edge turned up under nosing of brick to form a drip, and the inner edge to run at least 3″ under the succeeding course of brick, which will be laid on top of flashing to hold same in place; all mitres and joints of flashing to be neatly made and thoroughly welted and soldered watertight.

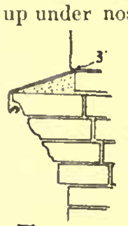


Fig 28

The top joints of all unflashed projections, etc., to be raked out and pointed full and flush with Portland cement mortar (one part cement and one part sand). All metal cap-flashings to have two coats of non-corrosive metallic paint and a finishing coat of lead and oil paint tinted to match the face brick.

Washing Down and Pointing. — At completion, the bricklayer to wash down and clean all face brickwork, using a solution of muriatic acid and water in proper [proportions one-half pound muriatic acid to a pailful of water; this will also remove efflorescence on brick caused by cement stains, etc.], to oil one coat, using color if necessary, and all joints to be neatly pointed and finished.

All scaffolding for building the face brick to be erected entirely independent of the walls, and no put-log holes in the face brick will be permitted at any time.

MEASUREMENT.

The brickwork in walls is measured in feet and inches and is estimated by the thousand. Many brick-masons in the eastern States measure thus: the length of the wall by the height, deducting the openings, and the surface thus obtained mulplied by the number of bricks to the square foot of wall, which, of course, depends upon the thickness, being generally taken at fourteen bricks for a wall one brick thick, twenty-one bricks for a wall one and one-half bricks thick, and seven bricks additional per square foot for each additional half brick thick; but generally speaking, the most of them measure the total cubic feet of brickwork in all walls and multiply by the average number of bricks per cubic foot as laid in the wall, generally about twenty, and this is the system in use by the Government. The net cubic feet of brickwork in the walls should be obtained; all openings over 2′ 0″ square should be deducted; for the deductions the heights of openings are taken only as high as the springing, both for segmental and semi-circular heads, as the cost of the centering of arch is worth as much as the brickwork for that space; all recesses in brickwork also to be deducted, and stone in brickwork, except bond and bearing stones in walls. Chases, air-spaces and flues of all kinds are not deducted.

After getting the cubic feet of common brickwork, the number of bricks to the cubic foot is obtained as follows: first, measure the exact size of the brick to be used, and, as the walls generally average not less than one and one-half bricks, estimate the number per cubic foot for a wall of this thickness; the mortar joints average generally ⅜″ thick, which thickness of joint must be added to the length and height of brick and two-thirds of this thickness to its width; after obtaining these dimensions, multiplying them together will give the number of cubic inches occupied by each brick, with its joints in the wall; dividing this number into 1728 will give the number of bricks per cubic foot.

Example.

Exact size of brick, 8⅝″ x 4¼″ x 2¼″.
Allowing for joints, 9″ x 4½″ x 2⅝″.

Multiplying the latter dimensions will give $106\frac{3}{10}$ cubic inches per brick. $\frac{1728''}{106\frac{3}{10}''} = 16\frac{1}{4}$ bricks per cubic foot.

It must be borne in mind that the sizes of bricks vary all over the

country; about the largest are made in Washington, Baltimore and Philadelphia, and about the smallest in Maine, the former averaging about seventeen to the cubic foot, and the latter about twenty-five; in New York State they average about twenty-one, and West and South twenty-two and one-half bricks to the cubic foot are usually estimated for, but this latter figure is too large, as the average will not exceed twenty.

The size of the moulds for brick are generally made 9″ x 4½″ x 2¼″, but as all clays shrink differently in burning, this partly accounts for the variation in size.

All facing and moulded brick are also estimated by the M. The plain facing brick are measured, reducing to square feet, allowing full measure at all angles and returns, to pay for the extra labor at those points, and multiplying by the number of bricks to the square foot (usually seven) obtained in same way as the number of common brick, adding ⅛″ for joint to length and height of brick.

Moulded brick are measured by the lineal foot for each different pattern, as the price is dependent upon the pattern, and allowing one and one-half bricks per foot for stretchers and three bricks per foot for headers; all angles and returns are measured full on both sides, also mitres. In deducting for openings in facing bricks, the height should only be taken to springing line, as in common brick.

Terra-cotta work is usually estimated at so much per piece, depending on the size and design of the pattern from those in stock, which, of course, cost less than special designs. Terra-cotta is usually made hollow, with the necessary flanges and stiffening ribs, but some few manufacturers make it solid.

COST.

The cost of brickwork depends on the cost of the bricks and delivering same at the building, the wages of brick-masons and helpers, the cost of mortar and the use of tools, machinery and scaffolding.

CONSTANTS FOR MORTAR PER M. BRICK.

M = .50 cubic feet (20 bricks per foot).
Sand = .35 cube yard.
Cement = 1.46 barrels of 300 pounds.
Or lime = 1.75 barrels.

Labor per M., including tools, etc., is about seven-eighths of mason's and helper's wages per day for ordinary city buildings, but for Government buildings it is about one and one-fourth times the same wages. This difference is principally because city houses generally have long party walls, with very few openings, and the frames for doors and windows are set in place while the brickwork is being built, whereas, in Government work, all four sides of the building are fronts, and there are a great many windows and openings in the walls, which, of course, take more time to measure and build to than if the walls were plain, and the frames of doors and windows are not put in the building until the masonry is completed and the roof is on; besides, as a general rule, the work is better and stronger. Some of the brick walls for the building now being erected at Rochester, N. Y., had to be taken down, on account of an extension having to be made, when it was found necessary to drill and split the brickwork with wedges in order to get the walls down, the cement mortar very often being stronger than the brick.

A brick-mason with helper should lay in common house walls 1,200 to 1,500 bricks per day of ten hours; in Government work, the average is from 800 to 1,000 for common brick and in pressed and moulded brick from 150 to 300 per day.

COST OF COMMON BRICK PER M. DELIVERED.

1884.	Columbus, O	$ 6.00	1886.	Pittsburgh, Pa	$ 8.00
"	Baltimore, Md	8.00	"	Des Moines, Ia	10.00
1885.	Jackson, Miss	4.00	"	Dallas, Tex	8.50
1882.	Toledo, O	8.00	"	Jefferson City, Mo	8.00
1883.	Denver, Col	7.50	"	Rochester, N. Y	8.00
1886.	San Francisco, Cal	8.50	1884.	" "	7.00

COST OF BRICKWORK PER M. LAID COMPLETE.

1884.	Poughkeepsie, N. Y	$21.50	1885.	Fort Wayne, Ind	$16.00
1885.	Dallas, Tex	16.00	1884.	Rochester, N. Y	14.00
"	Brooklyn, N. Y	15.35	1886.	" "	15.50
"	Pittsburgh, Pa	14.00	"	Des Moines, Ia	17.00

PRESSED BRICK.

Bricks alone, delivered, cost from $20.00 to $30.00 per M.; selected red, about $15.00 to $18.00 per M.

COST PER M., PRESSED BRICK, LAID COMPLETE.

1884.	Poughkeepsie, N. Y	$60.00	1885.	Brooklyn, N. Y	$40.00
1885.	Jackson, Tenn	65.00	1886.	San Francisco, Cal	45.00

Moulded bricks cost from $40.00 per M. up to $120.00, depending upon the profiles; the average for the profiles ordinarily used is about $70.00, and the cost of laying averages about $30.00 per M.

Enamelled-bricks, on edge, cost about $68.00 per M.,
" " and end, cost about $ 75.00 per M.,
" " and flat, " 100.00 "

and the cost of laying them is from $30.00 to $35.00 per M.

The price of terra-cotta depends upon the pattern or design, the average cost per square foot of exposed surface laid in wall complete being, for stock patterns, about $1.50, and for special designs, from $2.00 to $2.50.

JAS. E. BLACKWELL.

[To be continued.]

SOME DATA ON STEAM-HEATING.



Belfry. Bruges

THE following data on steam-heating, taken from my note-books, cover some points which were arrived at in the course of professional practice, and which have stood the test of years of special experience.

When the direct system is used to heat buildings such as abound in our great cities — buildings in which the street floor is a store, and the upper floors are devoted to sales and stock rooms and to light manufacturing, and in which the fronts are of stone or iron, and the sides and the rear of building of brick — a safe rule to follow is to supply one square foot of boiler heating-surface for each seven hundred cubic feet, and one square foot of radiating-surface for each one hundred cubic feet of contents of building.

For heating mills, shops and factories, one square foot of boiler heating-surface should be supplied for each four hundred and seventy-five cubic feet of contents of building, and the same allowance should also be made for heating exposed wooden dwellings. For heating foundries and wooden shops, one square foot of boiler heating-surface should be provided for each four hundred cubic feet of contents, and for structures in which glass enters very largely in the construction — such as conservatories, exhibition-buildings and the like — one square foot of boiler heating-surface should be provided for each two hundred and seventy-five cubic feet of contents of building.

When the indirect system is employed, the radiator-surface and the boiler-capacity to be provided will each have to be, on an average, about twenty-five per cent more than where direct radiation is used. This percentage of twenty-five also marks approximately the increased fuel-consumption in the indirect system. When the overhead system of steam-heating is employed, in which system direct-radiating pipes, usually one and one-quarter inches in diameter, are placed in rows overhead, suspended upon horizontal racks, the pipes running horizontally and side by side around the whole interior of the building, from two to three feet from the walls, and from two to four feet from the ceiling, the amount of one and one-quarter inch pipe required, according to Mr. C. J. H. Woodbury, for heating mills (for which use this system is deservedly much in vogue) is about one foot in length for every ninety cubic feet of space. Of course, as Mr. Woodbury points out, a great range of difference exists, due to the special character of the operating machinery in the mill, "both in respect to the amount of air circulated by the machinery, and also the aid to warming the room by the friction of the journals."

Prof. Charles A. Smith gives the following data for the relation between radiating-surface and cubic contents, as representing the results of the practice of the Dubuque Steam Supply Company, Dubuque, Iowa. He says: "We find that with the external air ranging to 0 degrees Fahrenheit, one square foot of heating-surface warms a number of cubic feet, as follows, in columns 2 and 3":

CLASS OF BUILDING.	When heaters are in same rooms (direct system), cubic feet per square foot.	When heaters are in basements (indirect system), cubic feet per square foot.
Dwellings	50	40
Stores, wholesale	125	100
" retail	100	80
Banks		
Offices	70	60
Drug stores		
Dry goods	80	70
Large hotels	125	100
Churches	200	150

For determining the cross-sectional area of pipes (in square inches) for steam-mains and returns, it will be ample to allow a constant of .375 of a square inch, plus, for each one hundred square feet of heating-surface in coils and radiators, .375 of a square inch when exhaust-steam is used, .19 of a square inch when live-steam is used, and .09 of a square inch for the return. If the cross-sectional areas thus obtained are each multiplied by one and three-elevenths, and the square root extracted from each product, the respective figures obtained will represent the proper diameters, in inches, of the several steam-pipes referred to.

To the following table, presented by Mr. William Kent, M. E., in Vol. VI of the "*Transactions of the American Society of Mechanical Engineers*," relating to the height and dimensions of chimneys required for the several horse-power of boilers mentioned, I desire to give my cordial endorsement, as it accords well with the figures of dimensions which have given the most satisfactory results coming within my own experience and observation. During the last two years I have had occasion to test its value at least twenty-five times,

and in some cases have instituted changes in large steam-plants on its basis, with the most gratifying results :

Diameter of round chimney, in inches.	Height of Chimney. 50 ft.	60 ft.	70 ft.	80 ft.	90 ft.	100 ft.	110 ft.	125 ft.	150 ft.	175 ft.	200 ft.	Side of square chimney, in inches.
	Commercial Horse-Power of Boilers.											
18	23	25	27									16
21	35	38	41									19
24	49	54	58	62								22
27	65	72	78	83								24
30	84	92	100	107	113							27
33		115	125	133	141							30
36		141	152	163	173	182						32
39			183	196	208	219						35
42			216	231	245	258	271					38
48				311	330	348	365	389				43
54					427	449	472	503	551			48
60					536	565	593	632	692	748		54
66						694	728	776	849	918	981	59
72						835	876	934	1023	1105	1181	64
78							1038	1107	1212	1310	1400	70
84							1214	1294	1418	1531	1637	75
96								1496	1639	1770	1893	80
99									1876	2027	2167	86

— *Alfred R. Wolff, M. E., in the Stevens Indicator.*

COMMUNICATIONS

RECTOR PIERSON'S GRAVE.

BOSTON, July 5, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT :—

Dear Sirs, — I thank Mr. William P. Pierson for his kindness in correcting the misstatements I made in the Rector Pierson article that appeared in the *American Architect* of June 4.

I sent a man to Clinton, Conn., to get information about the Pierson memorials, and he was told by an old resident of the town that the old red sandstone tablet was believed to mark the grave of the Rector. When I wrote the article I noticed that the date on the stone made him an old man, though not one of an impossible age.

My statement that Gen. Wm. A. Pierson, of Windsor, Conn., was "the only living male descendant of Rector Pierson, the first president of Yale," was made to me by the general himself, in 1872, and under the following circumstances: When the Pierson statue was first under consideration he said to me that he supposed, as he was the only living male descendant of the rector, and as he had often been told that he closely resembled his ancestor, that the sculptor who should make the statue would probably take his type of head and general *physique* as a guide, if not as the basis of his work.

The appropriateness of this supposition was peculiarly manifest and just, for the general was a fine-looking man and illustrated the temperament of the scholar and gentleman. After he saw the statue in the sculptor's studio, he expressed to me his strong disapprobation of its lack of any family resemblance, or of its indicating anything especially characteristic or illustrative of his ancestor.

Having kindly set me right in regard to the grave-stone of one of the sons of the rector, and stated the interesting fact that many hundreds of his male descendants are living, will Mr. Pierson please to state where the ashes of his ancestor do repose, and whether there is any stone to mark the place? Thus enabling me to complete a full statement concerning an important point, the last resting-place of the first president of Yale, and what his many hundred male descendants have done to keep it in remembrance. T. H. BARTLETT.

THE EXHIBITION OF PEN-AND-INK DRAWING.

ST. PAUL, MINN., July 28, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT :—

Dear Sirs, — My first impression upon opening your last issue was that you were kind-hearted sorcerers, and, having discerned one of the most wished-for wishes of my heart, had taken the trouble to realize it and delay my journal just so that it arrived here on my birthday — yesterday.

Leaving metaphor alone and relating plain facts, I will tell you that for years back I have been comparing the work of our best draughtsmen and trying to determine whose style of rendering I liked best, so that I could adopt it — or, at least, modestly try to imitate it; but the drawings were all so good, and the subjects, of course, differed so much, that I found myself still plodding along in an old rut that I fell into, way back in the "forties."

Of late I have been thinking over some scheme or another to get three or four sketches of the same object, by different artists, but never said a word about it excepting that it would be next to impossible to get them (at least without $). So that you can easily imagine how delighted I was to see the Messrs. Fenn, Gregg, Kirby & Company's sketches. I am going to have them all framed and hung up in my bed-chamber, hoping that they will affect me as beautiful statues and paintings are supposed to have affected the Roman matrons of old; of course I don't want to be affected in *exactly* the same manner, but — well, you know what I mean.

I would have been content to enjoy this great pleasure in silence had I not heard several old fogies complaining that the "*American Architect* was going down hill" — nothing but a lot of pictures and trash, no more *architecture* like there used to be in the ——— and ——— journals, when they (both fogies and journals) were young.

Now, gentlemen, I will not ask you to perform the "father, son and donkey" act, but you have so often delighted and instructed us young ones of the new school, that we can well afford to be generous to the old chaps, and contemplate sending you a well-signed petition shortly, asking that you sacrifice one whole page per year to these "old fogies," and that upon that page be depicted a beautiful scroll-sawed "bracket" in all its agony. In the meantime, I am, gentlemen,

Yours most gratefully, J. W. FITZPATRICK.

[OUR correspondent's remarks suggest the desirability of complaints being made to us direct. — EDS. AMERICAN ARCHITECT.]

A GOOD LOCATION FOR ARCHITECTS.

NEW YORK, July 26, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT :—

Dear Sirs, — By statistics which come before your notice, can you give me your opinion as to a good location in the West for an energetic young man just starting in the profession. I would like a city of fifty to seventy-five thousand inhabitants with a goodly amount of building. Please confer a favor in letter or paper, as I am a reader.

Respectfully, L. D. CARTER.

[KANSAS CITY, MO., offers, perhaps, the best opening. — EDS. AMERICAN ARCHITECT.]

NOTES AND CLIPPINGS

A MINIATURE MODEL OF HEIDELBERG. — Homer says that, to the sound of music and by magic forces, the walls of Troy rose in one night, but with no more marvellous impulses than are to be found in the deft fingers of a patriotic old man, the ancient German city of Heidelberg has sprung up on the south shore of Staten Island. This American duodecimo edition of the famous city is on the grounds of Mr. Alois Peteler, a native of Bavaria. The idea was suggested upon his return from several years' travel in Europe, during which his permanent resting-place had been Heidelberg. With numerous photographs, drawings and plans of Heidelberg, aided by a thorough knowledge of his subject, Mr. Peteler began the foundation of his little city, and now, sitting on his comfortable front porch, can look over the roofs of this town of Lilliput, and into the court-yard of the great castle, so rich in romance, tradition, and folk-lore. Every detail of the original structures is reproduced with the fidelity of the photographer, and all with the delicate touch of an artistic hand. From the balcony it is easy to imagine that it is the real city, only dwarfed by a distance of perhaps four or five miles. Looking over the battlements of the castle and between the houses and great buildings one can see the turbulent waters of the Neckar hurrying past to join the Rhine; below the fertile valley (formed by a stretch of the green sward of the garden) and against the horizon the outlines of the distant Vosges mountains, created from a grassy mound of irregular earth. The little city is built to endure. There are no makeshifts, no glue, pasteboard, or carpet-tacks, but stone, cement, gravel, brass and iron. The buildings are upon a plateau of stonework elevated by stone steps. The houses are about five feet in height, while the tall towers of the castle run up to six or seven feet. Guilliver's description of his visit to Mildendo, the metropolis of the kingdom of Lilliput, would serve very nicely in describing a walk through the reduced Heidelberg.

In walking about the Staten Island city of Lilliput it was not necessary to take off your coat for fear of damaging the houses with the skirts, they were built too solidly for that; and in the court-yard of the castle it was only needful not to take too long steps for fear of damaging some of the small gardens or running into the picturesquely-covered well. The age of the little half-ruined walls and towers and of the ancient buildings and palaces is very well simulated. With hammer and chisel to crumble the stone, and the aid of one or two powerful acids, Mr. Peteler has worked wonders, and the shattered portion of "the blown-up tower" of Heidelberg lies in a bit of ditch moss-grown and aged exactly like the famous original.

Not being subjects of Lilliput, Mr. Petefer's visitors did not pass under the teeth of the wooden portcullis which projected from the archway of the great entrance to the castle on the south side, and on which two lions guardant are cut in bold relief, but contented themselves by looking over the battlements into the square upon which various buildings front, studying them from the convenient rustic seat.

A familiar German tradition is recalled by a deep well, over which is a ornamental roof supported by stone pillars.

"In Heidelberg it is known as the '*Buben quelle,*'" Mr. Peteler said, "and it is regarded with mystery by all the children, for the mothers of Heidelberg tell their children that it is there they were found, as in Holland they tell them that a stork brought them."

"There is no romance more interesting than the history of Heidelberg castle," said the patriotic old man, who was apparently delighted to talk of his hobby; "that palace is the northern portion of the castle square; it was for many centuries the residence of the Electors of Palatine, who were the immediate governors of Heidelberg. The many architectural styles in the group of buildings shows the taste of their various founders and the history of some of the buildings is very interesting."

While the courteous old man talked, the afternoon sunshine flooded

the great square of the little Heidelberg. A narrow black line rent aslant the upper front of the palace. It was the shadow on the sun dial, and it marked the hour of 4. "The sun dial is just as it is in Heidelberg," he said, "and I can tell the time as well on the little face as by my watch."

Frederick's palace, which is shown on the northern side of the little square, is of the most beautiful design. Mr. Peteler has reproduced, with the greatest fidelity, over a hundred busts of the electoral governors which are used in the decoration of the front of the palace. Even the coats-of-arms and quarterings over the entrances are clearly cut. The little building is constructed entirely of cement, which has hardened in the sun to the consistency of stone. It is of a warm red in color. The blown-up tower, half of which is an artistic heap of ruins, was manufactured out of fresh Portland cement. It was blown up by the French during the Thirty Years' War, but the masonry was so massive that it simply split in two, one-half remaining erect and the other half falling into the ditch of the castle.

Another interesting building is the miniature "English palace" at Heidelberg; there is a pretty arch in front of it which commemorates the marriage of Frederick V to the English princess. Next to the palace is a wee bit of a garden with some tiny plants growing in it. In the original garden, Mr. Peteler declared, the English princess took her walks.

Conducting his visitors around the square, Mr. Peteler led them up a short flight of steps, and through an aperture in one of the buildings showed them a fac-simile of the famous Heidelberg Tun. It is really thirty-six feet long and twenty-four feet high, and capable of holding 284,000 bottles of wine, although the little model is not more than twelve inches in length and six or eight high. On the top of the great tun is a platform on which the old gentleman said eighteen couple could dance. At the back of the castle is a broad balcony which overlooks the lower town. Mr. Peteler placed his finger on the imprint of a human foot cut into a cement floor of the balcony. "This is where a knight alighted who jumped from an upper window at the sacking of the castle by the French. The foot print will be found in the balcony in Heidelberg." There are in the square several statues, or statuettes, and among them one of Marshal Wrede, who led the Bavarian forces as late as 1813. In another part of Mr. Peteler's grounds the sea water is let in by pipes and forms an artificial lake, in which tide rises and falls. Upon a promontory which juts into the lake is the beautiful castle of Hohen-Schwangen. Its towers are nearly ten feet high, and with its cluster of buildings it is picturesque and beautiful. On another bank of the lake is the castle of Sunneck. — *Boston Herald.*

The End of Natural Gas in China. — Two hundred years ago in China there was just such a craze about natural gas as we have in this country to-day. Gas wells were sunk with as much vim and vigor as the celestials were capable of, but owing to a gas explosion that killed several millions of people and tore up and destroyed a large district of country, leaving a large inland sea, known on the maps as Lake Foo Chang, the boring of any more gas wells was then and there prohibited by law. It seems, according to the Chinese history, that many large and heavy-pressure gas wells were sunk quite near to each other. Gas was lighted as soon as struck, as is done in this country. It is stated that one well, with its unusual pressure, by induction or back-draught, pulled down into the earth the burning gas of a smaller well, resulting in a dreadful explosion of a large district, destroying the inhabitants thereof. Lake Foo Chang rests on this district. The same catastrophe is imminent in this country, unless the laws restrict further developments in boring so many wells. Should a similar explosion occur there will be such an upheaval as will dwarf the most terrible earthquakes ever known. The country along the gas belt from Toledo, through Ohio, Indiana and Kentucky will be ripped up to the depth of 1,200 to 1,500 feet, and flopped over like a pancake, leaving a chasm through which the waters of Lake Erie will come howling down, filling the Ohio and Mississsppi valleys and blotting them out forever. —*Cincinnati Commercial Gazette.*

The Air of Sewers. — Professor Carnelley, D. Sc., and Mr. Haldane, of University College, Dundee, have been investigating the impurities of sewer-air, and find that the organic acid in the sewers examined was about twice and the organic matter three times that of the outside air, whereas the number of micro-organisms was less. As regards the quantity of these three impurities the air of the sewers was better than the air of naturally-ventilated schools, while even mechanically-ventilated schools were more polluted with organic matter. The sewer-air contained a much smaller number of micro-organisms than the air of any class of house, and the carbonic acid was rather greater than in the air of houses of four rooms and upwards, but less than in two and one-roomed houses. As regards organic matter, however, the sewer-air was only slightly better than the air of one-roomed houses, and much worse than that of other classes of houses. The amount of carbonic acid found by the observers shows that the sewers observed were better ventilated than those investigated by previous observers. They attribute the excess of carbonic over that of the outside air chiefly to oxidation of organic matter in the sewage and the air of the sewer. The excess of organic matter is probably chiefly gaseous, and derived from the sewage itself. The micro-organisms in sewer air come entirely, or nearly so, from outside, and are not derived, or only so in relatively small numbers, from the sewage itself. This important conclusion is proved by the facts that the average number of micro-organisms in sewer-air was less than in the outside air, namely, as nine to sixteen; that the number increased with the efficacy of the ventilation; that the average proportion of moulds to bacteria in sewer-air was almost exactly the same as in outside air at the same time, whereas one would expect the proportion to be very different were the outside air not the source from which they were derived, seeing that such a difference has been proved to exist in the air of houses and schools. Another consideration is that the filthiness of a sewer seems to have no influence on the number of micro-organisms. Further experiments in the laboratory showed that the number of micro-organisms in sewer-air is diminished nearly a half in passing along a moist tube five feet long and one-and-three-fourths inches in diameter, at a rate of nearly one foot per second. There was, however, distinct evidence of the occasional dissemination of micro-organisms from the sewerage itself; especially in splashing, owing to drains entering the sewers at points high up in the roofs. It is therefore important that drains should be arranged to avoid splashing. The authors' conclusions tend to make one more doubtful of the supposed evidence of the bad effects of ordinary sewer-air, when not vitiated by splashing.

A Pneumatic Tube to Europe. — Col. J. H. Pierce, of Saithington, who has been studying the use of pneumatic tubes, has reached a point at which he hopes to show that a tube across the Atlantic can be used. Following is a description of the apparatus as he conceives it: The tubes will always be in couples, with the currents of air in one tube always moving in an opposite direction from the other. The heaviest cannon will serve to illustrate the tube. A car takes the place of the charge, the tube to be indefinitely continuous and the speed of the car to be governed by the rapidity with which air can be forced through. Time is required to establish a current of air flowing with great swiftness through a tube perhaps thousands of miles in length, but when once created the motion will be nearly uniform. The speed of the current may be made as great as may be desired by using the steam driver fans employed in blast-furnaces. Niagara Falls could drive blast fans and furnish motive power to keep in motion the trains to connect this continent with the old world. The temperature within the tube may be regulated by passing blasts of air entering the tube through furnaces or over ice. The speed attainable may reach 1,000 miles an hour. The tube lining and car exterior would be of polished steel with corrugated sides matching with wheels provided with anti-friction bearings. The speed, owing to the curvature of the earth's surface, will tend to overcome all weight, and the pressure will be upon the upper part of the tube; thus there is scarcely any limit to the speed attainable. The inventions consist in the details of the work.— *Hartford Courant.*

TRADE SURVEYS

The trade conditions are more favorable to-day than thirty days ago. A heavier demand than was anticipated has been experienced in all trade channels. The conservative management of manufacturers and merchants has done very much to maintain the present healthy and steady trade conditions. Prices in some lines have advanced ten per cent. Orders for certain staple products have grown beyond expectations. Business is gratifying, and the prospects for August are more favorable than were anticipated only two weeks ago. One of the powerful, but not visible agencies is the demand for machinery of every kind, and motive-power, rolling-stock, mining equipments, and agricultural and mining tools and appliances. An extended inquiry among these interests develops the very encouraging fact that all establishments are sold up for from two to three months, and that new business is presenting itself constantly. The progress made in the production of superior grades of steel has something to do with the activity in iron and steel channels. Our progress in this direction within two years has attracted the attention of home and foreign governments and of large users of steel for guns, ships, and other purposes where large homogeneous casts are demanded. Our steel works are surpassing foreign competitors in quality, as they long since did in the production of a superior iron and steel rails. Were it possible to present the statistics of machinery and equipment output it would surprise every one connected with the industry. The expansion is extraordinary. There is, perhaps, not a railroad in the United States but what has orders out for rolling-stock and track or shop material and supplies. The locomotive and car builders have recently advanced their prices on first-class work, as the pressure for prompt delivery is greater than for years. The demand for machine-shop equipments has grown to very large proportions. Lathes, cranes, boilers, engines, everything which goes into machinery-making is wanted faster than present capacity can deliver.

The general business of the country is on a solid basis. There are no symptoms of weakness. Money is abundant. The reported volume of business in thirty-eight cities is eleven per cent ahead of what it was for same date last year. Railroad earnings show a most favorable comparison. Speculation is stagnant. Legitimate enterprise is in the saddle. Investments are being made rapidly and safely in all the leading avenues of activity. Good earnings are the rule. Failures are few. Collections are for the most part easily made. Merchants large and small are doing a good and safe business. The sheriffs have but little to do. Mortgages to avoid disaster are exceptionally few. Litigation is at a lower point than for many years between business men, and the efforts made to establish private boards for the settlement of trade differences are meeting with encouraging success. The barbarous methods of law courts are driving many into arbitrative devices. The wood-working industry and the wood-working machinery interests have an excellent season before them. The iron and steel makers anticipate an autumn advance in prices. Orders for all kinds of material are coming in without undue solicitation. Rail-making and bridge-building will be the most active lines. The fifty banked-up blast-furnaces will soon be blowing. Several new rolling-mills will be in operation in September. One hundred new pots for glass-making will be in. Shop-capacity representing 20,000 men will be placed in running shape between September 1 and November 1. The lumber trade is gaining every week in distribution and in prices.

Heavy fall and winter contracts are now being placed for spruce, white and yellow pine and hemlock, besides hardwoods. Stocks at Atlantic-coast points are large for the season. There are urgent river and lake tonnage requirements, and all yards are receiving orders for crafts, big and little. The size of some of the recently-ordered crafts is limited only by the harbor and wharf capacity. It is evident that the influences at work are widening demand rather than restricting it. The authority of some of our most experienced architects can be had for this statement. Whatever the next year may have in store it is safe to say that from the present indications there will be no idle manufacturing-capacity, no idle building-labor, and no idle, or partially-employed capital beyond the usual reserve. High banking authorities say that the demand for funds will be exceptionally large during the next four months, and that railway bonds and stocks will attract greater attention than in former years, because of the generally favorable condition of traffic and trade.

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CONTENTS

THE Annual Report of the Massachusetts Bureau of Statistics of Labor for 1886 contains more than its usual amount of interesting matter. This is not saying very much, for worse padded specimens of literature than the series it was never our misfortune to see, but in the present instance it is possible to pick out from the mass of double-leaded eulogy of persons connected with the Bureau, and rambling, inconsequent observations on the subject-matter of the few statistics presented, some facts of value. Among these the most valuable are those relating to coöperative enterprises. In the book two separate chapters are devoted to these, one entitled "Coöperative Distribution," and the other "Profit Sharing," as if it had been intended to speak in the first only of the associations for selling groceries and other articles to members at reduced prices which are so popular in England; but this chapter contains a good deal belonging properly to the other, particularly a table showing the present condition of some of the French productive societies of the kind. We could excuse this being in the wrong place if it were as good as it might be, for the recent history of coöperative production in France is of the greatest interest and importance, but the table is confined to the Parisian societies, is poorly translated, "*terrassiers*" being rendered "terrace-makers," and "*sculpteurs*" as "sculptors," and most of the interesting details, such as the rate of dividends paid, are left out, so that we learn almost nothing from it except the fact that there were, when the table was compiled, at least seventy-four such societies in Paris, without counting the powerful building syndicates, of which we find only one mentioned, and that a very small one.

THE story of the real societies for coöperative distribution is familiar to most persons, and the Report does not give a remarkably good abstract of it, or very valuable comments on it, but we can glean something. Aside from the enormous development of the business of such associations, which in 1883 had six hundred and eighty thousand members in Great Britain, and sold one hundred and forty million dollars' worth of goods, with a net profit of eleven million dollars, the most interesting detail which we find is a short account of the first successful enterprise of the kind in England, the "Rochdale Pioneers," which began business in 1844 with twenty-eight members and a capital of one hundred and forty dollars, and, under the management of poor weavers, has now reached an annual business of nearly a million and a half dollars, and has a million and a quarter of invested surplus, and, besides spending regularly more than five thousand dollars a year for charitable purposes, pays an average dividend of over fourteen per cent to its members. Reasoning from the English examples, the writer of the report says, rather hastily, as it seems to us, that, although "in the United States the isolated store must miss the valuable help which the English stores have in the organization that has grown up as the movement in that country has gained strength," still, "if stores were to multiply in America the same organization would follow here, and, meantime, the recorded experience of English effort, if availed of among us, would prevent serious errors in the conduct of business." This has a plausible air, and it would be very pleasant if it were true, but the English statistics do not contain all the data required, and we would not advise any one to risk money in a coöperative store in this country at present. One of the sort, which, by the way, the Report does not mention, was started in Boston two or three years ago. It struggled along for a time and then failed, and we remember hearing at the time a comment, which contains food for thought, by a sensible business man, who observed that in England for many years nearly all retail business had been done on what we should call long credit, and the system of the coöperative stores, which gave no credit at all, brought them at once the immense business advantage which a retailer with only cash customers has over competitors loaded with bad debts and uncollected bills, and they have prospered accordingly. Among us the case is very different. Nearly all retail business in groceries and supplies is done for cash or on short credit, and a coöperative store managed on the same system must compete on equal terms with rivals having at the start certain advantages instead of disadvantages, so that, although one would not like to say that an American coöperative store could not succeed, the road to success appears to be here a good deal longer and harder than exceptional circumstances have made it in England.

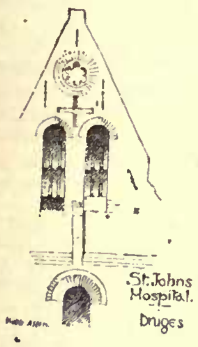
IN respect of associations for production, we are much more nearly on an equality with the rest of the world, so far as favorable circumstances are concerned, and experience shows that we are likely to hold our own before long with any country, unless, perhaps, France, where the principle of coöperation and participation in profits has been taken up by the Government and people with that almost religious fervor with which the French adopt a great idea. It is much to be wished that a good history of profit-sharing in France might be published in this country. Something is known here about the principal facts; but the details of the various movements, which would be full of instruction, are almost entirely wanting. The Massachusetts Report is very defective, even in what it pretends to give. Something is said about the Leclaire experiment, the Paris and Orleans Railway Company, the Bord piano-manufactory, and the Chaix printing-office; but we find nothing about the scores of more modest establishments which furnish the examples most needed among us, or about the syndicates, composed entirely of workmen, which now carry on a very large amount of manufacturing business in France. These would be the most interesting examples of all. There is a very common idea that working-men lack entirely the judgment and training needed for business success, and that coöperative shops are sure to fail, for want of the guiding care of some person of mercantile instincts, entrusted with the sole control of their affairs; or, to put it in the other form in which it often appears, that participation schemes can only work well so long as the proprietors of the business keep the reins in their own hands; and that any plan under which the persons employed are allowed to share the responsibility, as well as the profits, of management, is sure to end in disaster. The question whether this notion is well founded or not is certainly the most important one that the subject now presents; and the existing examples have become sufficiently numerous to afford statistics of great value, which might be collected without much difficulty, and would be far better worth publishing than the undigested mass of excerpts from popular books, of not too recent date, which constitute a large part of the Report. For our own part, we have never been so much impressed by the wisdom and prudence, to say nothing of the honesty, prevailing in the business world as to believe it impossible for sensible mechanics to sell the boots or furniture which they made without falling headlong into financial ruin; and, although we suspend our judgment until some one furnishes us with more facts than are at present available, we find

a certain comfort in the evidence which we can incidentally obtain from the Massachusetts Report. Although this contains next to nothing about the financial success of any of the numerous French societies, we find, singularly enough, indications of encouraging experiments carried out in Italy, among people who are generally supposed to be sunk in lethargic barbarism, and in England, which some sage not long ago pronounced to be a country unfitted by nature for coöperative production. In Italy the most interesting associations seem to be those formed among laborers — a class so ignorant that even among us they are regarded as incapable of doing anything except under surveillance of an overseer, while the success of a Southern planter in training large baboons to take the place of the men whom he formerly employed has been gravely commented on throughout the country. The Italian laborers certainly do not appear the most intelligent of their kind, yet they have had sense enough, in certain districts, to form a number of coöperative associations, which take large contracts for earthwork or grading, and sub-let them in sections to their own members, who work by the piece. As no capital is required, except for shovels, pickaxes and wheelbarrows, the cost of shares is small, and the piece-work system makes it easy for the men to appreciate the benefits of putting thought and energy into their labor. They have been tolerably quick to learn the lesson, and the average earnings of the members of the associations, who have to compete for contracts with the private individuals who, as we are told, alone possess the business training necessary for financial operations, earn, on an average, three times as much as they did while working under private contractors. It is hardly necessary to say that such prosperity attracts members, and a Ravenna society grew from three hundred to three thousand within a year. In England, although coöperative distribution has reached a far greater growth than coöperative production, an immense amount of factory stock has quietly passed into the hands of operatives, the spinning factories at Oldham, for instance, being mainly owned by the workmen, about ten thousand of whom hold shares in the various mills, while many manufacturing establishments are conducted entirely on the coöperative plan. Most of these have grown out of coöperative distributing associations and are rather small affairs, although one of them sells a quarter of a million dollars' worth of calicoes annually. No details are given, unfortunately, of their financial success, but we get a curious hint, in the shape of a rule existing in a large number of them, by which the regular customers of the establishment, as well as the stockholders, share in the profits. This idea is undoubtedly a reminiscence of the distributing society from which they sprang, and at first sight appears rather absurd; but a society of workmen, carrying on business with a small capital, could hardly devise a better means of advertising themselves, and bringing about them a set of reliable customers, who would have an interest in extending their connection, in treating them with forbearance in case of accident or press of work, and even in helping them through slight financial difficulties.

Of American examples of profit-sharing we find very few, and trust that the subject will be taken up again next year, with special attention to the recent instances of the *Herald* Publishing Company in Boston, the Batterson Stone Works at Westerly, R. I., Mr. Lewis H. Williams's Building-Shop in New York, the Wanamaker establishment in Philadelphia, and the many other experiments on a great scale which are now in operation. The principal example mentioned is that of the Pillsbury Flour-Mills at Minneapolis, an enormous establishment, with an income of eighteen million dollars a year, in which, after paying current expenses and interest on capital, a certain percentage of the residue is divided annually among those employés who have been in the establishment more than five years or who occupy positions of special trust and responsibility. As a very large number of men is employed, the participation is not extended to all indiscriminately, but is thus held out as a prize for faithfulness and intelligent devotion to work, and a very handsome prize it is, the dividend last year, in addition to the regular wages, which are said to be the highest paid in any mills in the country, having been fifty per cent of the entire year's wages for the five-year class, and sixty-five per cent for those who had held responsible posts. In the same city many small coöperative barrel-factories are said to have been recently established, and it will be interesting to learn whether they share in the vigorous growth of the flour-mill near them. Of the strictly coöperative factories existing when the report was written, ten were in Massachusetts, and were engaged in making either boots and shoes, or furniture, or iron castings, and ample information is given in regard to them. Of the three iron foundries, one had paid ten per cent dividends for four years, besides high wages, some of the moulders having received, besides their dividends, nearly two thousand dollars a year. The next had paid six per cent annually for four years, besides good wages, and the least successful paid three per cent. Of the two chair-factories, one had made good profits for eight years, using them partly to pay five or six per cent dividends and partly to increase capital and replace plant destroyed by fire, while the other, though paying wages and expenses and keeping solvent, had not reached a dividend-paying basis. The shoe-factories, which complete the list, have been most successful of all, one having paid for eleven years dividends varying from six to forty per cent on a capital of twenty thousand dollars, besides wages and expenses, and the only other factory described which had been in existence more than three years, had paid from ten to twenty-five per cent for the last five years, while the younger ones, although some of them had not paid any dividend, were rapidly increasing their business. In all these the managing officers have been chosen by the operative stockholders, and were in some cases themselves operatives, and their success certainly does honor to their capacity.

After several years of talking, preliminary steps have actually been taken in Buffalo for utilizing the water-power of the Niagara River, by the circulation of a paper which pledges the signers to contribute toward a fund of one hundred thousand dollars, which is to be offered as a prize for the best plan for making the force of the river available for use. It is estimated that the power developed by the cataract of Niagara and the rapids just above it is about a million and a half horse-power; and it has the inestimable advantage of being nearly constant, the flow over the fall, supplied, as it is, by the vast reservoirs of the lakes, being hardly affected by the change of seasons, or by a heavy rainfall, and it is not surprising that the practical men of Buffalo should look with longing eyes at this gigantic force, going to waste, as they think, so near them; while the extraordinary advances made of late years in the art of transmitting power, particularly that derived from falling water, render it more likely now than ever before that their wishes may be in some degree gratified. If we had the spending of the hundred-thousand-dollar fund, knowing, unfortunately, the bad reputation of American competitions, we should send first to Paris for M. Marcel Deprèz, who probably knows more about the electrical transmission to a distance of the force of falling water than any other person living, and pay him a part of the money for devising a scheme, keeping the rest to help pay for carrying it out. Scores, we might almost say hundreds, of waterfalls abroad are utilized by means of electricity for supplying light, so that the art of entrapping the force is already well understood by many engineers; but the most important experiments in the way of transmitting the power as power have all, so far as we know, been made either by M. Deprèz or by using devices acknowledged to be of his invention, and they have proved very successful. In South-eastern France a cataract, harnessed by his skill, has for some years driven machinery in a town ten or twelve miles away, with a surprisingly small loss of force; and a similar scheme, on a very large scale, is now being carried out in Spain. While we are by no means averse to competitions as a means of stimulating professional skill, where the judgment can be made by experts perfectly familiar with the subject, the case seems to us different with essays in a comparatively unknown field. The unsatisfactory results which have attended the attempts to obtain suitable electric-motors for the elevated railways in New York show how difficult it is to judge the merits of such devices by any other method than that of long use; and it seems to us that in a competition for mere suggestions, such as that at Buffalo must be, the prize would be quite as likely to fall to a plausible enthusiast, whose claims for his own invention no one could, of their own knowledge, dispute, as to a man of real skill, whose greater experience would have taught him how great a deduction for contingencies must be made in estimating results of this kind, while his more sensitive conscience would not allow him to make promises which he could not be sure of fulfiling.

BUILDING ACCIDENTS.[1] — III.



THERE have been a great many disasters to buildings in New York which have occurred within my knowledge, and I herein propose to give a brief account of some of them, and point out how, in my opinion, they might have been prevented.

Many years ago a row of buildings, which were in process of erection, fell. I do not remember how many persons were injured. The loss of property, however, was very great, as the beams, window-panes, lintels, and sills were very much broken. The cause of the fall of these buildings was not at all difficult to trace.

1. The mortar was made chiefly of loam, the bricks were laid dry, so that there was no adhesion of the mortar to the brick.

2. No care was taken to brace the walls of each story during the process of building.

3. The beams were roughly handled as they were taken into the building preparatory to their being lifted to their place in the upper tiers.

4. Their weight, they being piled on the second tier, pressed down the beams which were set, drew the walls of the story above inward. This proceeded in like manner to adjoining houses as the work progressed. When the buildings were nearly topped-out, the walls, being unbraced, could no longer stand the rough usage they were subjected to, and fell.

Had the mortar been made of clean sand and the bricks sufficiently wetted just before being laid, the walls would have been very strong; then the walls should have been well braced, in each story, and the braces should have been well secured to beams that were well supported from below, the braces to remain until the roofs were on. If all these matters had been attended to the building could not have fallen.

A large number of buildings have fallen during the process of erection from similar causes, within my recollection, but in no case were they being built by their *bona-fide* builders, but by speculators who build to sell, and study in every way to build cheaply.

CASE NUMBER 2.

I now propose to state one case of a great number in which the fall of the walls resulted chiefly from a cause different from the foregoing.

Three buildings on one street, and four on another were commenced about the middle of December. The foundation, or cellar-walls were built of very ill-shaped stone. No pains were taken to hammer or tool them to proper beds, and the mortar was of inferior quality. Owing to the shape of the stone, a large quantity of mortar was used to fill the cavities.

Just as the cellar walls were built the weather became very cold, and the walls were frozen solid.

Whenever the weather moderated sufficiently, even for a few hours, the brick walls were laid upon the frozen foundation-walls, which now, being shaded by the floor-beams, remained frozen. By-and-by the roofs were put on, and the brown-stone fronts set, and all frozen.

In a few days a thaw set in, which first caused the brick walls to buckle, by thawing on one side more than the other. Then a warm rain came on; the frozen cellar walls thawed, and the buildings fell. Happily, no one was injured, as the building fell very early in the morning, before men went to work.

I visited the ruins and was astonished at the recklessness on the part of the owners in using such materials. What little bed the stone had was lost by the expansion in freezing of the great mass of mortar.

CASE NUMBER 3.

This was the case of the settlement of a portion of the flank wall of a house, and occurred about twenty years ago. The building was used as a hotel, and patronized by the élite of the city, as well as by distinguished persons from abroad, and stands on the corner of a street and avenue; it faces the avenue and runs down the street about two hundred feet. The side of the building parallel with the street, and facing the yards, and for the space of twenty feet in width and for about fifty feet high, settled about three inches. All the other parts of said wall, each side and above, remained intact. This settlement was a great disfigurement as, independent of cracks, it caused the floors of several stories to tilt towards this outer wall.

It was suggested by several persons that the settlement was caused by a stream of water that had found its way under that part of the foundation, and carried away the earth. The owner of the building called upon me to investigate the matter, and, when I had found the true cause, to repair all damages.

From my knowledge of the ground, before the building was erected, I was well satisfied that no water had found its way under the foundation-walls.

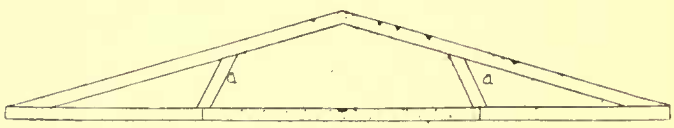
The tenant had enlarged the capacity of the hotel by taking-in several private dwellings on the avenue, and then found it necessary to increase the cooking arrangements. He employed a person to set an additional range just where the wall afterwards settled; also, to make a doorway to an area. In so doing the range-setter had cut away so much of the lower part of the wall, just above the foundation-stone, that what remained was insufficient to sustain the weight above; consequently, the lower three courses of brick were crushed to powder. Had not the beams of each story been anchored to the wall the latter, no doubt, would have fallen outward. The true cause of the settlement being ascertained, the wall was screwed up to its proper position and underpinned, so as to have sufficient area of wall below to sustain the weight above with safety.

The employment of a competent person in the first instance would have saved considerable expense. "Prevention is better than cure."

CASE NUMBER 4.

About ten years ago a two-story building, about thirty feet deep and one hundred and fifty feet front, was erected, the rear part of which abutted against another building.

The trusses of the roof were placed twelve feet apart and anchored to the outer wall, which was twelve inches thick in second story, and made as follows: The tie-beam was made of two pieces of 3″ x 7″ timber, in two lengths, and a piece of



same-sized stuff spiked to the side to hold them together. The pieces *a a* were plank spiked to rafter and tie-beam. The weight of the roof with ceiling attached and the snow were sufficient to gradually force the two pieces of the tie-beam apart lengthwise; also to separate them from the piece that was spiked to them, drawing and bending the spikes.

Owing to the building abutting against another at the rear, all the movement was towards the street, until it culminated in throwing the greater portion of the front wall down, as the roof fell in, killing several persons who had just left the building.

The engineer who had charge of the property told me, after the accident, that he was very busy at the time, and left the matter to the carpenters. We see the result.

The trusses of the new roof, which was afterwards put on, will stand until the materials decay.

Had the trusses been properly constructed, and bolts been used in place of spikes, if of sufficient strength to resist the shearing-strain, with due allowance for safety, the lives of worthy people would not have been lost.

CASE NUMBER 5.

This was a case where a building was put to a use quite different from that contemplated by the owner who built it. It was built for an express company and used by them for some years, and afterwards used for the wholesale grocery business.

There was a line of brick piers 2′ 8″ x 2′ 8″ about twelve feet from centres in cellar, with the usual bond-stone, and a granite cap-stone on top, ten inches thick. On this rested iron columns eight inches in diameter, set on iron plates twelve inches square and one inch thick. The columns supported brick arches and the floors above. The great weight of goods stored on the several floors had split many of the brick piers, and the bond and cap stones, and some of the brick arches near the tops of columns were also displaced.

[1] Continued from page 36, Number 604.

The sudden settlement of a portion of the floors alarmed the occupants, and at once measures were taken to prevent further movement. It was found that in some places the goods were piled up from floor to ceiling in the lower stories, and that the settlement jammed them in, and thus, no doubt, saved the building.

The piers and arches were repaired, and the occupants notified how much weight might, with safety, be placed on each square foot of floor surface.

The tenants said they had been informed that they could load all the floors to the extent of four hundred and fifty pounds per square foot; this was one hundred and fifty pounds more than authorized by the New York building-law, and no doubt the floors were loaded many times more than that.

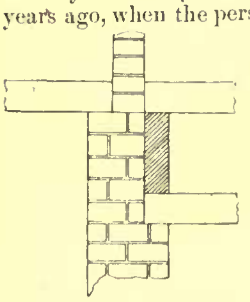
It is certain that the cap-stones of the piers under the iron columns were not thick enough, nor the iron plate under columns large enough or thick enough to transmit the weight from the column to the full size of the brick pier. Had they been so the pier would not have split, notwithstanding they were so greatly overloaded.

CASE NUMBER 6.

An accident by which ten persons lost their lives.

About sixty years ago four buildings were erected on the southeast corner of Grand Street and Laurens Street, now called South Fifth Avenue, built by a man I knew well. They were two stories high, with a pitch roof, a style of building quite common in those days. The first floor was about three feet above the sidewalk. The cellar walls were of stone twenty inches thick, all other walls eight inches thick, of brick.

They had always been occupied as dwellings until about eight years ago, when the person who owned the corner house desired to lower the beams of the first floor of his house to the level of the sidewalk, and fit up a gorgeous drinking-saloon. He applied to the then Building Department, who permitted him to cut away one side of the stone cellar walls, to allow the beams to be lowered as shown in the sketch.



The shaded part shows the part that was cut away, the cutting away of which destroyed the integrity of the wall by breaking the bond and loosening the stones.

In a short time after this was done, and the saloon fitted up in mahogany, hiding the wall completely, the vibration caused by the loaded wagons running on the pavement in the street caused the party-wall to settle down, and carried all the walls of two houses with it, causing the loss of life above stated.

The mistake, no, *the crime*, was in cutting the stone wall.

The proper way, in my opinion, would have been to have shored up the party-wall and the floor-beams of both sides, then to have taken down the wall to the point to which the beams were to be lowered, and after they were in position, to have built up new brickwork to support the beams of the adjoining house and the party-wall, or to have sawed off the beams and built up an eight-inch brick lining alongside the old wall to support them.

CASE NUMBER 7.

Some years ago a change was made in the flour mills of Jones & Company, in New York. In making the change it became necessary to remove a large chimney and to build a new one in a different location. This chimney was about one hundred and ten feet high, and, from long use, the mortar, on being removed, crumbled to sand and powder.

The persons having charge of the work set men to work at the top of the chimney to remove the bricks and mortar and throw them inside the chimney. They had removed but a small portion of the top when the accumulated débris on the inside pressed out the bottom part of the chimney and the whole fell, killing two men.

This accident might easily have been avoided by enlarging the flue opening which entered the chimney near the bottom, and placing across the inside of the chimney planks at an inclination of about forty-five degrees, which would have thrown out the bricks and mortar as fast as it was thrown in at the top, and men could have removed it as it came out, leaving the hole clear.

Wm. P. Esterbrook.

[To be continued.]

ANCIENT AND MODERN LIGHT-HOUSES.[1]—XIV.



HALFWAY ROCK, ME.

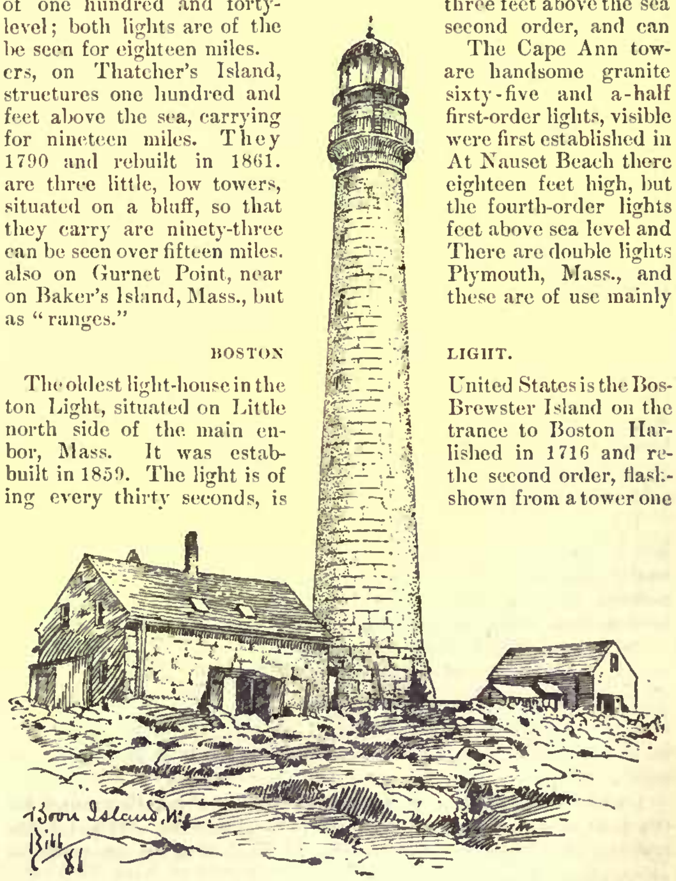
THIS light-house, located on a barren rock, so swept by the sea that there is absolutely no soil, contains the dwelling and living-rooms of the keepers, and forms their rather desolate residence. From a distance the gray granite tower, showing a third-order light eighty feet above the sea, appears to stand in the water. The rock is so storm-swept that landings are almost impossible except in pleasant weather: a boat-house was built here of concrete, but the ways where first placed were destroyed by storms, so their location had to be changed, necessitating the cutting of the boat-house in two.

The light-house was built in 1871.

BOON ISLAND, ME.

Like the preceding, this light-house also seems to spring from the waves; the granite tower is one hundred and twenty-three feet high, its base being ten feet above the sea level; alongside is the granite dwelling for the keepers. It was built in 1812 and shows a second-order light visible for eighteen miles.

Before the improvement in the lenticular apparatus had reached its present perfection, by which the characteristics of adjacent lights can be made so dissimilar that there can be no danger of confounding them, the same object was secured by building two, or even three lights close together on the point to be marked. Some relics of this expensive, and, I trust, obsolescent custom still remain. Notably, at Cape Elizabeth, Casco Bay, Me., at Thatcher's Island, Mass., and at Nauset Beach, Cape Cod, Mass. At Cape Elizabeth the two towers were built in 1828, and show the one a white light and the other a white light varied by a white flash every minute at a height of one hundred and forty-three feet above the sea level; both lights are of the second order, and can be seen for eighteen miles. The Cape Ann towers, on Thatcher's Island, are handsome granite structures one hundred and sixty-five and a-half feet above the sea, carrying first-order lights, visible for nineteen miles. They were first established in 1790 and rebuilt in 1861. At Nauset Beach there are three little, low towers, eighteen feet high, but situated on a bluff, so that the fourth-order lights they carry are ninety-three feet above sea level and can be seen over fifteen miles. There are double lights also on Gurnet Point, near Plymouth, Mass., and on Baker's Island, Mass., but these are of use mainly as "ranges."



BOSTON LIGHT.

The oldest light-house in the United States is the Boston Light, situated on Little Brewster Island on the north side of the main entrance to Boston Harbor, Mass. It was established in 1716 and rebuilt in 1859. The light is of the second order, flashing every thirty seconds, is shown from a tower one hundred and eleven feet above sea-level, and is visible for sixteen and one-half miles. The following account of this light, and of some of its various vicissitudes is taken from the *Boston Evening Transcript* of August 26, 1880.

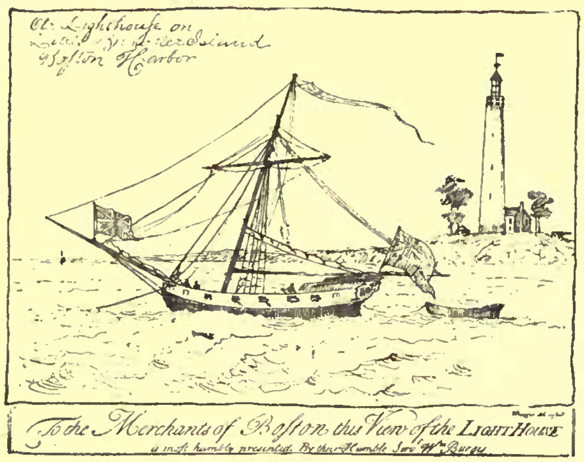
In the *Evening Transcript*, copied from the *Providence Journal*, the latter paper is mistaken in saying that the light-house built in 1740 on Beaver Tail, the south end of Conanicut, was the oldest light-house built on the New England coast, or even on the American coast; the second being the Brant light, entrance of Nantucket Harbor, in 1754, etc.

[1] Continued from page 16, No. 602.

Our Massachusetts records, and also those of Nantasket (Hull), give evidence of one built by the Massachusetts Colony thirty-four years previous to 1749, viz.: "The General Court of the Province [of Mass. Bay], order a Light house erected by the Province, June 9, 1715, & a committee named to build it, viz: William Payne, Colo. Samuel Thaxter, Colo. Adam Winthrop, the Hon. William Tailer, & Addington Davenport added to it. Approved by Gov'r Dudley — enacted in July, & 1*d* a ton inward & 1*d* a ton outward to be paid to the Receiver of Imposts by all ships or vessels except coasters: & an application made to Hull for little Brewster for it, £60 allowed Payne and Capt. Zac Tuthill to build and finish it. Lt Governor Tailer assented." The cost was £2,385 17*s.* 8½*d.*

Hull generously assented as "at a legal meeting of the Proprietors of the undivided lands in Hull, on Monday, Augt 1, 1715 Colo. Samuel Thaxter for the com'e on application for building a light house on Brewster Island, so called, adjoining to the Great Brewster, being present and 'censeble' of the general benefit to trade and particularly to themselves, by unanimous vote have granted the said Brewster Island in the Province of Mass Bay for the use of a Light house forever: provided said proprietors of the Great Brewster be held harmless. Hull Augt 1 1715."

"1716. A com'e of Hull petitioned the Genl Court for liberty to choose a Light House Keeper." But "June 25, 1716 the General Court appointed a committee to choose one, at £50 a year, & chose



George Worthylake, husbandman, Æ. 43, as the 1st keeper." In the second year, on his petition, his salary was raised to £70 as "he lost 59 sheep by drowning in a severe storm, his attendance on the Light House preventing him from saving them."

He and wife and daughter Lucy, or Ruth, were drowned November 3, 1718 going to Noddle's Island, and were buried in Copp's Hill cemetery, Boston.

Benjamin Franklin issued a ballad on the occasion and hawked it about Boston. November 18, 1718, John Haynes was chosen the second keeper of the light; he was a mariner and pilot, and resigned August 23, 1733, and was succeeded by Capt. Robert Ball, an Englishman, on August, 1733. He married Mrs. Martha King, of Charlestown, whose daughter Martha married Adam Knox. In 1776 the town of Hull dissented from Robert Ball's proposals, paying him "£5 for 4 years past & same anualy, as long as he keeps the Light House." By this, Hull had some interest in the keeper, or, perhaps, employed his services for the beacon or watch-house. Ball was taxed in Hull, 1767, but he refused, as non-resident; it was finally abated in 1774. His son, Capt. Robert Ball, sea captain, wills, in 1772 or 1782, Calf Island, Boston Harbor, and Green Island in Hull to his son John, and to his daughter Sarah, the outer Brewster Island (which was sold in 1794 for £50).

Robert Ball Sr. kept the light-house from 1733, under the Royal Government, to or after 1766, and one account thinks till after the British fleet left Boston Harbor in the Revolution.

June 19, 1746, John Fayerweather, a merchant of Boston, in his account-books on that date charges the "Town of Boston 50*s.*, cash paid at ye Light House *Tavern*, for sundry meetings held there with ye committee to measure ye rocks from ye lower middle ground, for order to sink hulks, if occasion, & 8*s* 6*d* more for drink, for the boats crew in April — total £3–4*s*–8*d.*" And gave an order to Henry King to receive it. He credits "received of King £2–19–8."

1751. The light-house injured by fire was repaired.

1775. The light-house in possession of the British fleet, was destroyed July 19 by the Americans; Admiral Graves of the British fleet repaired it.

July 31, 1775 the Americans again destroyed it; it was again repaired, and when the British fleet were driven from Boston Harbor Captain Bangs, of the "*Renown*," placed a train of powder under it and blew it up.

A keeper who was at the light-house with his wife when destroyed by the Americans, left his property and fled to Dorchester; there his wife saw one of her dresses on a woman in the street.

1783. Massachusetts rebuilt it, sixty-eight feet high, of stone, with four lamps of a gallon of oil each, and four burners, and on November 28th of that year, Capt. Thomas Knox, pilot, was appointed keeper by Governor Hancock. His father, Adam, and mother, Martha Knox, resided there with him; she died there January, 1790, and Adam died there December of the same year, aged eighty-one.

1790. The island was ceded to the United States. In 1829, Johathan Bruce, pilot, was keeper, being recommended by the Boston Marine Society.

Neal, in 1719, says: "The light house was built on a rock above water, 2 leagues from Boston, where, in time of war, a signal is made to the castle & by the castle to the town, by hoisting and lowering the Union flag so many times as there are ships approaching; if they exceed a certain number, the castle fires 3 guns to warn the town of Boston, & the Gov'r if needs be, orders the Beacon fires, which alarms the adjacent country, and gives 6 or more hours to prepare for their reception." "*Shaw's History of Boston*" (Pemberton's account), 1817, says: "Light House Island is a high rock of 2 or 3 acres, ⅔ of an acre of it good soil; a bar, dry at low water, connected with Great Brewster; a stone Lt house shows one light; it is 8½ miles from Long Wharf, Boston, and was formerly known as *Beacon* Island, &c.; pilots here have a piece of artillery to answer signal guns."

This and all the islands and Nantasket, including its beaches, were, on the settlement of the colony, covered with dense woods.



In 1676–77, the proprietors of Hull divided the wood on the lesser Brewster, as they afterwards did on the other Brewsters, to clear them for planting and grass, to be done by May 1, 1679, the land and lots to be divided by lot.

"Due me, Nat bosworth and gorg Vickare (of Hull) for going to bruister's islands, ...	2s. 6d.
For meeting the indians that cut the wood, pint wine . .	1s. 6d.
For going to tack the measure of the wood which I found corded, good and large measure; 240 cords and 2 large heaps, was carried to water side; that tho indians abeached was 30 cords more, so that the whole some was 270 cords, ...	2s. 6d."

1801. Sumner's "*East Boston*" speaks of the Brewsters wearing away.

1815. Boston Marine Society petitioned to have the light-house lit in winter (probably closed in war of 1812).

1860. The old tower was heightened and had a revolving-light. There was, no doubt, quite early a beacon and watch-house erected on Beacon or Light-House Island, as well as on Point Allerton Hill, by the town of Nantasket (Hull) to look out for and warn of an enemy's approach.

On the Massachusetts archives is this: "Hull, March 9, 1673–4. A true copy of the charges of the town of Hull hath been at about the Beacon, with the persons that *warded* the said Beacon, with an account of corne that was spoyled by carting over the said corne, and what was pluet up to set up the Beacon. The ward was, first, Benj. Bosworth, Sen'r, 17 days [other names omitted here] total 66 days. In the name of the Towne Serg't Bosworth, Nathaniel Bosworth.

"Charges about the Watch-house — timber & setting up, 2s., 300 of boards, 10s. 6d.; nails, 2s.; carting to the place, 2s. is £0 16s. 6d.; more for the beacon: a kettle, 5s.; for pitch, 2s.; John Loring & John Prince for making fier bales with pitch and ocum to make the bales, 1s. 6d.; for men to go to Boston to fetch more pitch for the beacon, 4s.; sum, £0 16s 6d.; total, £1 13s. 0d. For the corne spoyled by carting of the beacon setting up, which corne Capt. Oliver had a note of, to show to authority, which was three bushels."

March 9, 1673–74. The petition of the inhabitants of Hull about the trouble of setting and warding the beacon *erected on Point Allerton*, says: "We are a small people, our employment is wholly at sea, constantly every week of summer time, so that the whole burden lay upon a few men, whereby those men not only lost their time, but by continued working and warding, made unfit to carry on our employ, which we think is not the case with any other town in the colony. You do not consider how hardly it pinched us; yet we are assessed to pay our whole rate to the county & the castle. We think it too

hard, &c. Notwithstanding that at the request of the Hon'd persons betrusted with the castle edifice, who send to us to dig and have some stone quarried at Brewsters Islands, which we consented to, & gave a gratuity thereto to the number of 400 boat loads, we hear that other towns had abatement in those rates, but we have none, but the castle got our stones and we may pay for the boating of them. We request the Hon'd court to weigh well these premises, and doubt not that they will do right, and have sent this 2nd address, and we, committing you unto the Lord's direction, we take leave to rest yours, in all humble subscription, Nath'l Bosworth, Thos. Collyer, John Benson, Sen'r, John Loring, Robert Goold, Selectmen, and in the name of the rest, Hull, March 9, 1673–74."

Indorsed "The magistrates remit the town of Hull the county rate, their brethren, the Deputies, consenting, Edward Rawson."

"The Deputies consent *not* hereto, but judge meet to refer ye answer to the said petition to the next Court. The Hon'd Magistrates consenting hereto, Wm. Terry Oliver, 27-3-1674, consented to go to ye Magistrates, Edw. Rawson, 29 May, 1674."

Hull's county tax for 1674 was £8 4s. The beacons on Point Allerton and Beacon Island were, no doubt, the origin of the lighthouse on the latter.

THE ILLUSTRATIONS

[*Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.*]

HOUSE OF ALEXANDER MOSLEY, ESQ., COMMONWEALTH AVENUE, BOSTON, MASS. MESSRS. ALLEN & KENWAY, ARCHITECTS, BOSTON, MASS.

[Gelatine Print, issued only with the Imperial Edition.]

HOUSE FOR MRS. C. A. PLIMPTON, WALNUT HILLS, O. MESSRS. BUDDEMEYER, PLYMPTON & TROWBRIDGE, ARCHITECTS, CINCINNATI, O.

THIS house is situated upon a picturesque side hill among the trees in Walnut Hills, and was completed about three months ago at a cost of $10,000. The basement and first-story walls are of stone, rubble-work, and the second story of half-timber, with brick filling, the wood used being Mississippi cypress throughout; the interior finish being of the same wood with exception of hall staircase, which is of oak. The floors are of Southern hard pine and natural joists show in the ceilings, the plastering being done in between. The first and second stories, sides of dormers and chimneys are finished in cement, the last coat being "broomed on" and honeycombed with Ladd's Georgia white lime. The roof is of red shingle tile with terra-cotta ridge and hip moulds. All metal-work of heavy copper.

SKETCHES AT BELLE-ISLE PARK, DETROIT, MICH. MESSRS. DONALDSON & MEIER, ARCHITECTS, DETROIT, MICH.

THE Casino was begun in August, 1886, and completed in June, 1887, and is now in use as a resting-place and restaurant, etc.; it is finished throughout the interior in wood. Some suggestions of the interior are shown. The pumping-station and engine-room for water-supply and electric-lighting is of brick and stone. The pavilion contains dry-earth closets and urinals. The wharf-covering is of wood; all the last mentioned, *i. e.*, engine-house, pavilion and wharf-covering are in process of construction. In addition to the above work are a number of rustic bridges, boat-houses (one of which is shown), etc.

Plans for the general improvements on the park (which contains about seven hundred acres) including road and water-ways, lakes, bridges, etc., were adopted in January, 1887, and a considerable amount of this work has been done, as well as the buildings shown.

U. S. COURT-HOUSE AND POST-OFFICE, SAN ANTONIO, TEXAS. MR. M. E. BELL, SUPERVISING ARCHITECT.

CHURCH OF ST. JOUIN, MARNES, FRANCE.

DETAIL FROM THE CHATEAU DE BLOIS, FRANCE.

THE NEW BERLIN BUILDING LAW.—A revised law governing the erection of buildings has just been adopted by the municipal authorities of the capital of Germany. No new building shall cover more than two-thirds of the area of the building lot, and in the case of buildings erected in place of torn-down structures, on lots previously built upon, the area covered by the building shall not exceed three-fourths of the whole lot. The maximum height of any building is limited to seventy feet. All buildings must, moreover, conform to the law requiring the height of the street front, measured from the sidewalk to the main roof cornice, not to exceed the width of the street. Blocks of houses are permitted, but in the case of detached buildings the distance between two adjoining ones shall be at least eight feet, if there are no windows in the side walls, and at least twenty feet in the case the side walls have windows. These requirements are, obviously, intended to secure to the dwellings ample light and air, as well as sunlight for all living and sleeping rooms.—*Iron.*

THE IMPERIAL INSTITUTE.



MAISON DE LA RUE DU JOUR—Chef de Voûte
After LA CONSTRUCTION MODERNE

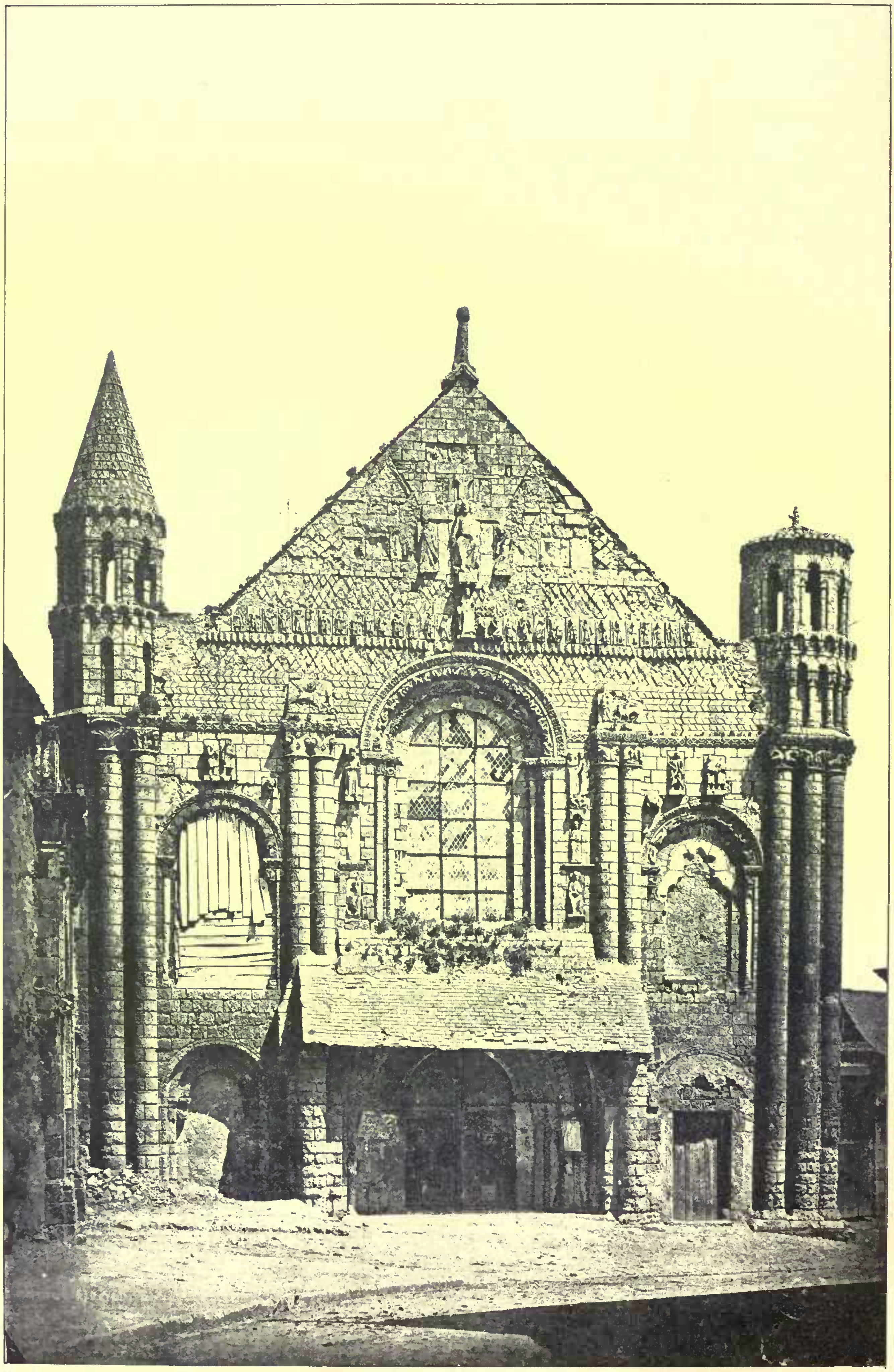
THE foundation-stone of this proposed new building was laid by Her Majesty the Queen, with great ceremony, on the 4th of July, and so the matter remains for the present.

As our readers are aware, the design of Mr. T. E. Collcutt, of Lancaster Place, Strand, has been selected for execution, and he has been formally appointed architect for the work. We feel quite sure it could not be intrusted to better or more artistic hands, but whether his design "after modification" will represent the Imperial idea one expects to see embodied in the architecture of this great public building is quite another matter. Mr. Collcutt's design is the result of a select competition limited to six architects—four representing England, or rather London, one Scotland, and another Ireland. The competition had, therefore, something of an international character about it which lent additional interest to the result. After the award was made the designs were on view to the public for about a week, and we propose to make a few remarks on this, the latest important competition of the day. As to the policy of limiting a competition of this national character to *six* architects only, or to the wisdom displayed in the choice of the six representative men, we do not propose to refer. What we have to do with is the result and its influence on the architecture of the day. The architects chosen to compete were Messrs. A. W. Blomfield, T. E. Collcutt, T. G. Jackson and Aston Webb & Bell, of London, Dr. Rowand Anderson, of Edinburgh, and Messrs. T. N. Deane & Sons, of Dublin. Their task was, in the first place, to design a public building wherein the Imperial greatness of the British Empire would find some fitting architectural expression; and in the second, to provide halls for meetings for Imperial purposes, exhibition-galleries for the display of Indian, Colonial, and home products, a series of offices for the Colonial Institute, the Asiatic Society, Emigration Society, etc., together with a library and other adjuncts. It is a great opportunity for the display of genius, the more so that there is little or no precedent for such a building. The instructions were necessarily vague on many points, as, apart from giving a general idea of the accommodation required, there was nothing to indicate how or in what manner it should be provided, or the relation of one department to another. All this was left to the skill of the designers, and as a consequence, where there was so little common ground to start with, the results are widely different.

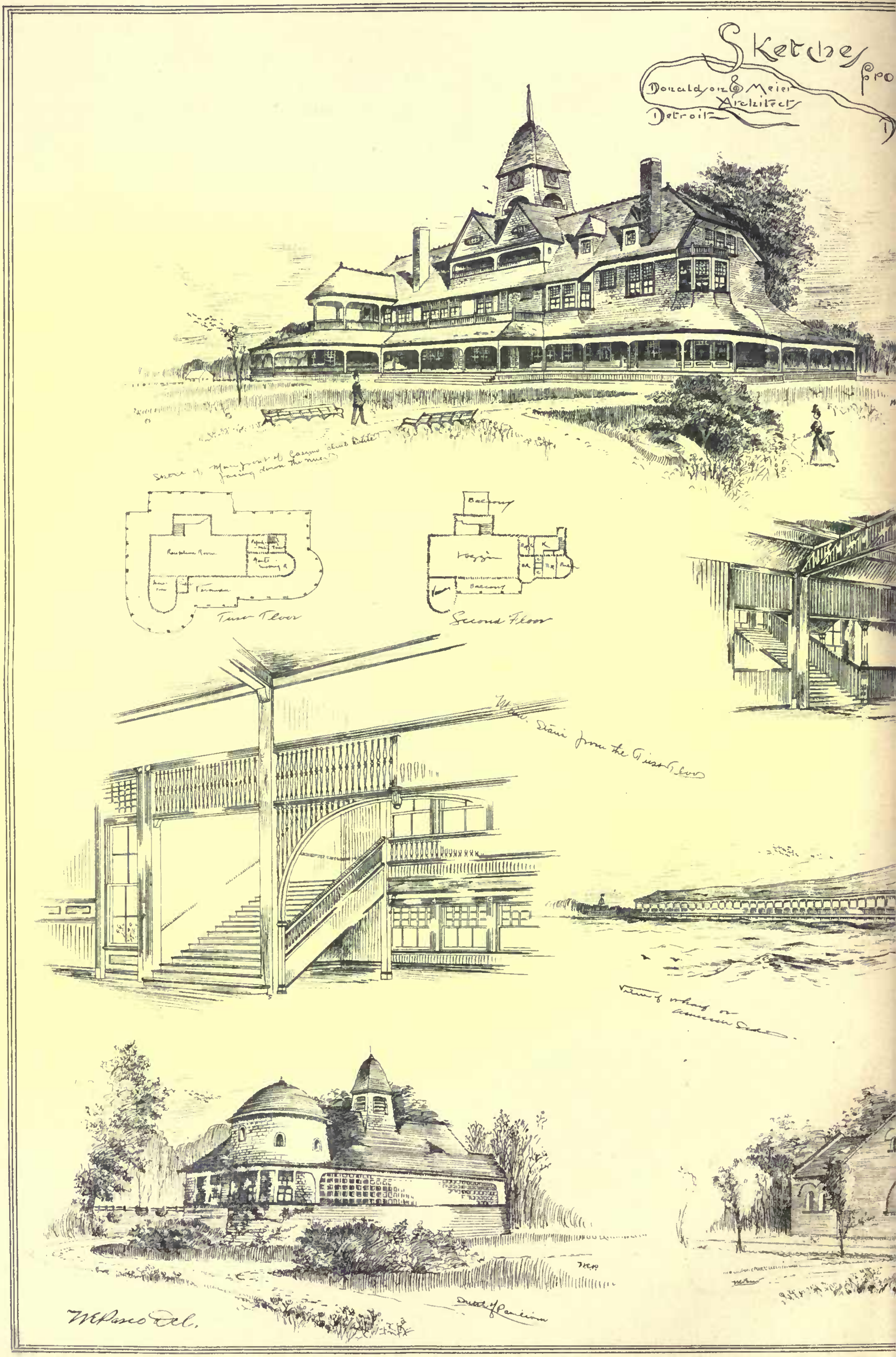
The site is on part of the grounds of the horticultural gardens at South Kensington, fronting on a new street proposed to be made behind the Natural History Museum, from Exhibition Road to Queen's Road—almost on the site of the great Central Avenue of late annual exhibitions—so that the front will be parallel to and facing the rear of the Natural History Museum. Into the wisdom of this choice of site it is useless now to enter; the point has been debated over and over again; it may make or mar the fortunes of the scheme, the future alone can tell which, and with the future we propose to leave it.

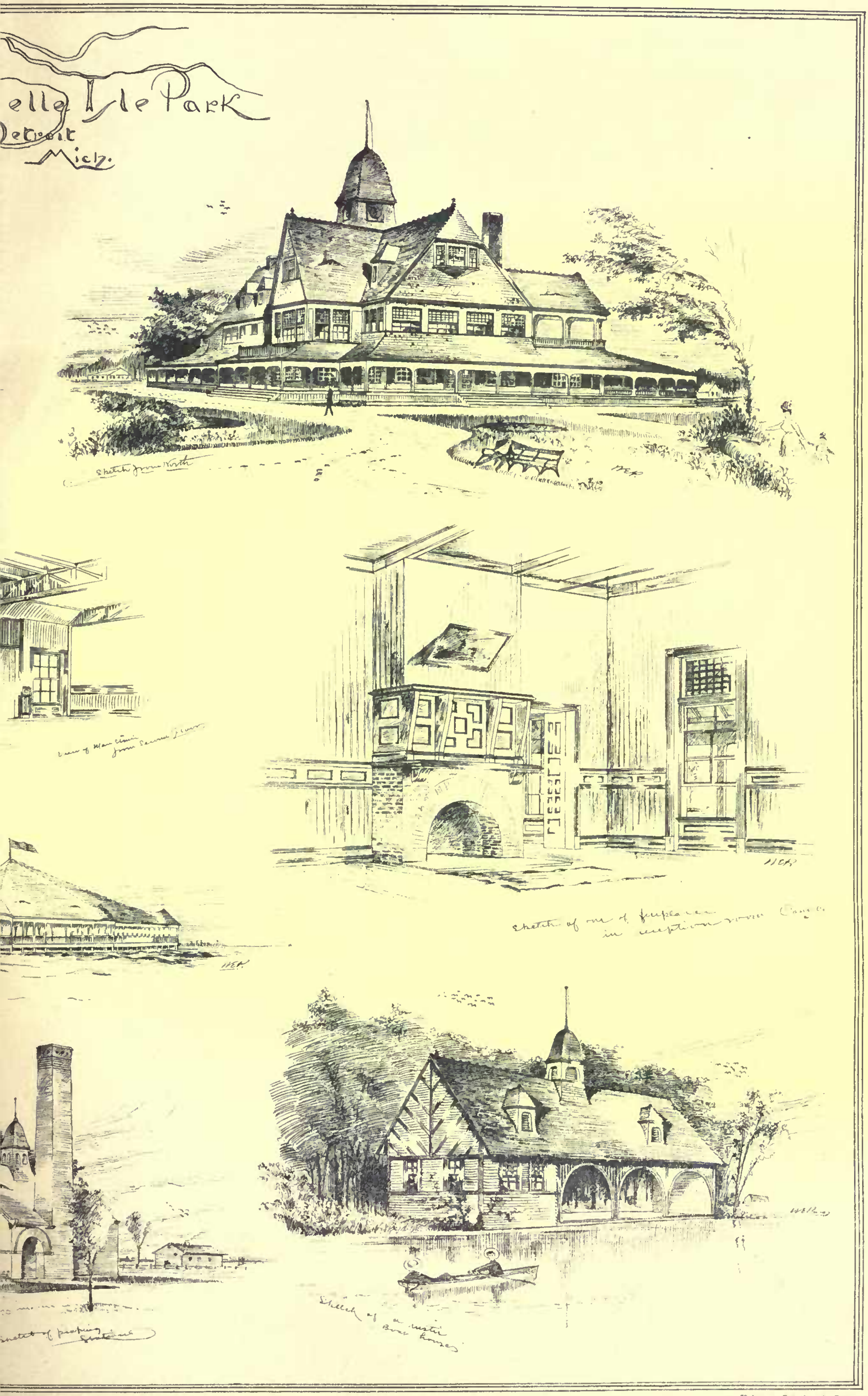
Taking a general glance at the arrangements of the six designs, they will be found to divide themselves into two types of planning—four designs in which the "reception-hall" is made the central feature and placed at right angles to the main front, and two in which this hall is placed to one side and parallel to the front. The first is undoubtedly the true one, and accordingly we find it so arranged in Mr. Collcutt's plan. All the halls are more or less of a basilican type, with a semi-circular apse at one end—and most of them with aisles. The offices of the various departments are generally arranged along the main front, and the exhibition-galleries around one or two courts. Three of the plans, viz., those by Mr. Collcutt, Mr. Blomfield, and Messrs. Webb & Bell are remarkably similar; and their arrangement is probably the best for purely exhibition purposes, as they not only provide the best galleries for the present, but also for future extension—one indeed, Messrs. Webb & Bell's, seems to be all galleries together, in fact, a vast museum.

Mr. Jackson's plan suggests a gigantic college. Dr. Anderson's much the same, only on a smaller scale—while Messrs. Deane & Sons' stands by itself, and is laid out with great architectural effect—a palace for Imperial purposes. Its chief defect is that the reception-hall is relegated to a subordinate position to one side—balanced by the conference-hall. Had the library taken the place of the former and the reception hall been placed in a central position, as in the selected design, Messrs. Deane's plan would have fulfilled the idea of an Imperial public building more fully than any of the others. Instead of this, however, its talented authors have let architectural grandeur run away with them to the extent of providing a vast useless "amphitheatre" as their "future extension," in which the exhibition-galleries are more or less sacrificed to purely architectural display. It is very magnificent, but it is not business. On the other hand, the "future extension" of the selected design savors too much of the "Brompton Boiler" idea, as if to provide great exhibition-galleries was the main object of building—and architectural



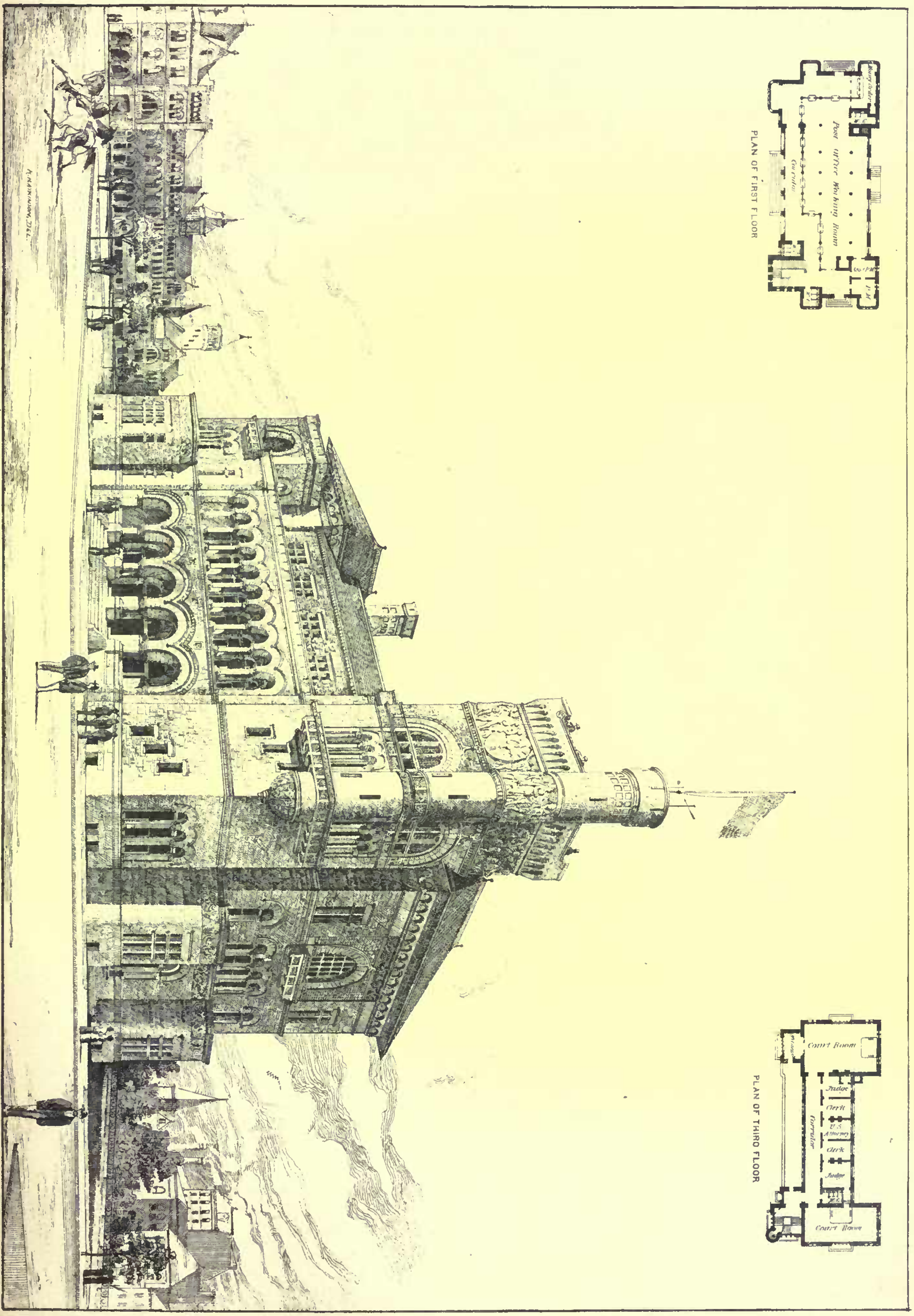
Heliotype Printing Co. Boston.


Sketches fro
Donaldson & Meier
Architects
Detroit
Balcony
Loggia
First Floor
Second Floor
Main Stair from the First Floor



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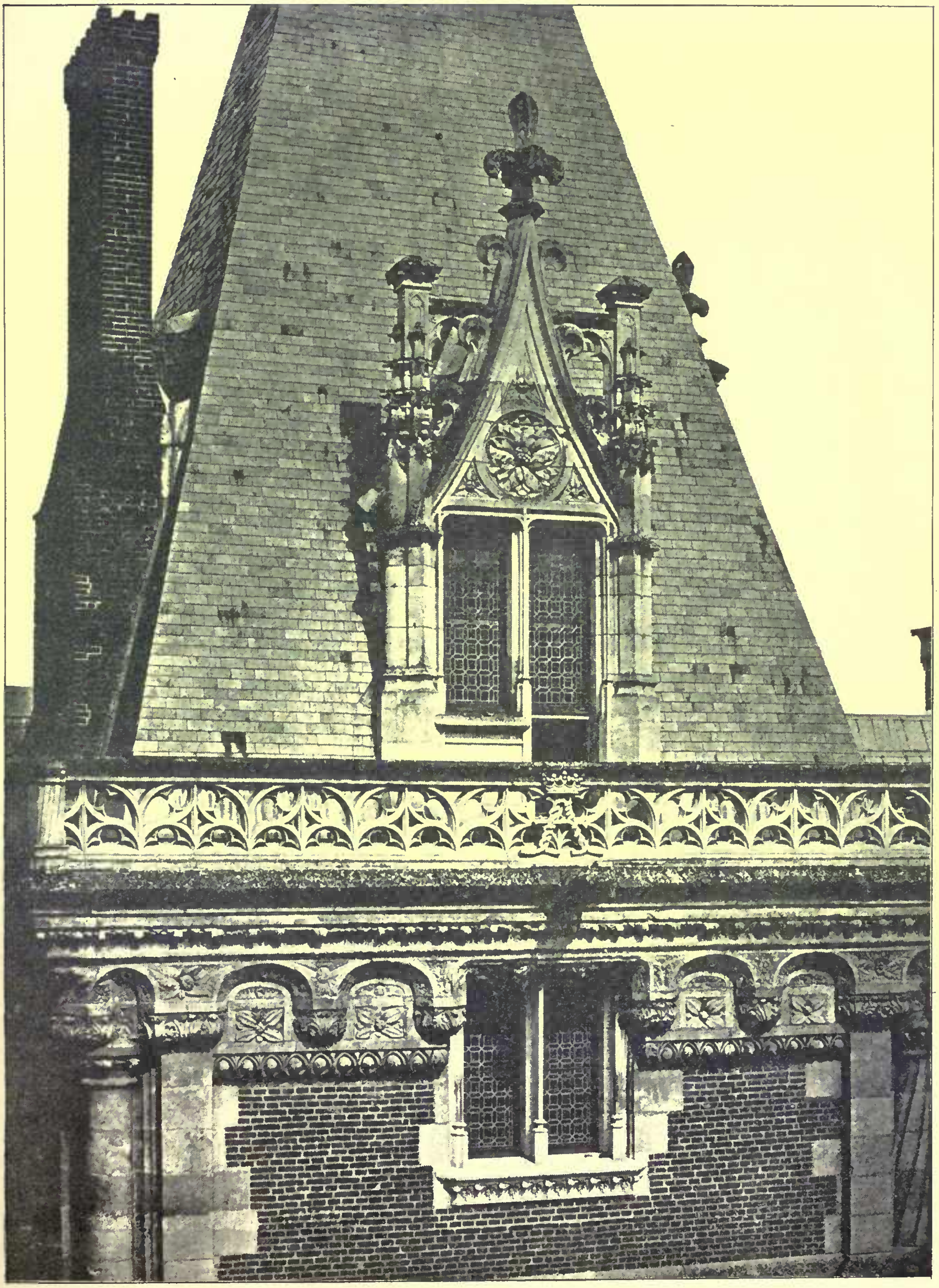
AMERICAN ARCHITECT AND BUILDING NEWS, AUG. 13 1887. No. 607



U.S. CT. HO. P.O. & C
SAN ANTONIO, TEX.

M. E. BELL,
Supervising Architect

American Architect and Building News, Aug. 13 1887. No. 607



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display becomes lost in the utilitarian. We apprehend something more monumental than this is wanted. The entrance to Mr. Collcutt's building is mean, compared to the sumptuous portico designed by Mr. Deane, while the central hall under the dome of the latter is in every way more magnificent than the somewhat limited vestibule and *cortile* of the former. Again, in spite of its being evidently designed for architectural effect Mr. Deane's plan is, in some respects, far more compact than Mr. Collcutt's — the library and the conference-room are miles away from each other (so to speak) in the latter — a great defect, we think — while in Mr. Deane's they are within easy reach for reference and consultation. The central block above the entrance in Mr. Collcutt's work is thrown away on nothing more important than refreshment-rooms and kitchens, while the great central portico rising through two stories in Mr. Deane's gives that dignity to the central feature which we expect and look for in such a public building. We have compared these two plans — as we shall presently do their architecture — at some length, as they are two such distinct types. The others that mostly follow on the lines of the selected design are probably not equal to it in general arrangement.

Mr. Jackson's plan is very picturesque, but neither it, nor Dr. Anderson's ever rises to the dignity of the occasion, either of them are more like college or University work; they seem to have missed the great idea.

What now is the result of this great competition from a purely architectural standpoint? With one exception we are struck with the moderation — almost the "smallness" — of the ideas set forth, and the eclectic character of the designs generally. The expected great architectural effort has not been forthcoming. The general effect is that of a number of small features, which might have done very well on a moderate-sized building, — spread out to do duty on a very large one — not only so, though, perhaps, from the nature of the case, the architecture is of the most nondescript character, showing there is no great school of architectural thought amongst us. It is all more or less the passing fashion of a day; the terra-cotta school, or the furniture school, or whatever it may be called, run rampant. There is nothing enduring, nothing distinctive, nothing monumental, nothing Imperial in it at all. People are fond of talking of the greatness of the British Empire and of comparing it with Rome — to the advantage of the former; where, then, is the expression of this greatness? Is it to be found in the prettinesses of these neatly-drawn designs? Fancy a Roman of the Imperial days standing before Mr. Collcutt's building and being told it is the embodiment of the might and majesty of the greatest empire the world has ever seen, would he believe his eyes or his ears? For assuredly he could not reconcile them; either it must be the capitol of a small Low Country state, or England is a very provincial empire after all. The Imperial Institute! There is nothing Imperial here. It is a very pretty, very artistic, very cleverly-designed block of offices, or big hotel, or apartment-house — it could hardly fail to be otherwise considering who its author is — and if this is all that is wanted it could not be in better hands, but of Imperial England at the height of its world-wide power, its unparalleled wealth, its historic glory, it tells not a word. Along its front, we are told, are bas-reliefs in panels, representing historic events. Pooh! they are far too small, they will be simply lost sight of in a building this size. So with all the other pretty little features, they will be nowhere. For all that, it is in many respects beautifully designed, detailed, and, above all, charmingly drawn, but it is all a huge mistake. It has neither the dignity nor the grandeur of a great monumental work. It is not to be mentioned in the same breath with Somerset House, much less with St. Paul's, or, if we go to the Palace of Justice in the capital of little Belgium, we find Great Britain is not even in the running.

Only one of the designs approaches within measurable distance of a great work — that by Messrs. Deane & Sons — and half its dignity is lost by the meaningless repetition of *eight* small domes all alike. Its central dome is but poorly conceived, a weak copy of the great St. Paul's: still the great portico, with its double range of columns and broad flight of steps, is stately; together they form a noble entrance. The quadrant loggias, which join the central block to the wings, are effectively planned, but the columns should have stood clear from the walls behind, so as to get the full benefit of the play of light and shade. On each side the central steps are placed two huge pedestals, with colossal statues thereon. They swamp everything else, and are quite out of scale with the portico behind. Much of the detail is of a meretricious character, not by any means equal to the spirit of the composition as a whole. Still, for all that, and allowing for many faults, this Irish design is worthy of the occasion — it appeals to the Imperial instinct, our friend, the old Roman, would at least be able to understand what it is all about—there is no mistaking it for other than a great national monument. The group of figures in the pediment of the great portico are big enough to tell their own story. Its general features are better proportioned to the size of the building than in any of the others. They would hold their own, they would not be lost in the size of the mass; there would be great play of light and shade over the recessed central block, the quadrants, and the advancing wings, and, another great point in such a site, it would never be taken for a part of the Natural History Museum in front of it as seen from Cromwell Road. Its distinct individuality would claim attention, not to say comparison with the big Museum, and it would not suffer by the contrast. Moreover, it is in a phase of architecture which has endured for centuries, of which there is an English version just as truly as there is English Gothic, and this English type of Classic has been aimed at here. We feel it is no passing fancy in red brick or terra-cotta, no creation of an hour any more than the empire it represents, but that it carries on its face an historic tradition, telling of a past as well as of a present, and in this way is an embodiment of the Imperial idea. Again, it is founded on a type of planning peculiarly English, as witnessed in Blenheim and a dozen other great buildings throughout the country, and in this respect is more national than any of the others. We don't want a Flemish or a Dutch Rath-haus, or a Romanesque palace, but an English public building, and, curiously enough, the Irishmen have given us the nearest approach to it. It is understood, however, that the *cost* of Messrs. Deane's scheme put it quite out of the competition. So much the worse for the competition and for the Imperial Institute. Belgium is said to have spent £3,000,000 sterling on her new Palace of Justice; rich England can only afford a tenth of this for what is destined to become one of the most important of her public monuments!

The design by Dr. Anderson is also in eighteenth-century Classic of a somewhat Adam's type, but it never rises above the commonplace in architecture. Indeed, the Scotchman is altogether out of running, his design is the poorest of the lot; he evidently has failed to grasp the greatness of the opportunity.

The remaining three designs are all of the nondescript type. Messrs. Webb & Bell's is, we presume, "Romanesque." It follows closely in the style of Mr. Waterhouse's Natural History Museum, only richer in detail, so much so, indeed, that if it were built, it would inevitably have been mistaken for a portion of it in the general view of the two from the south. Its principal feature is a great campanile, called "The Queen's Tower" — standing clear of the building in a kind of open square in front of the main entrance; two subordinate towers flanking the central block are so like Mr. Waterhouse's work that they might have been designed by him. It appears intended for execution in terra-cotta, and looks exactly what it is — a vast museum.

Mr. Jackson's work in red brick with stone dressings looks more like a Flemish Rath-haus; it has a great central tower reminding one of the Low Countries. It has a straight front, broken at the angles by octagonal towers, and divided into a series of bays terminated by gables, very much in the style of his recent work at Oxford. An open carriage-porch marks the entrance. It is full of charming detail such as we expect from Mr. Jackson, but that is all. It might be almost any kind of an "Institution" but an "Imperial" one, and we are forced to regret that this clever artist has failed to rise to the occasion. Much of the work both in plan and elevation is exceedingly quaint and picturesque, but we fancy these qualities are not quite all that is wanted in a great public building. The tower dwarfs the whole composition and seems quite out of scale with the rest of the front. There seems, also, a lack of harmony in style between it and the rest of the work, particularly in its upper stages.

The remaining design, Mr. Blomfield's, is of a nondescript Classic type. Its principal feature is a central dome over the entrance-hall, with a two-storied carriage-porch projecting in front. Like Mr. Jackson's tower, this dome is in a different type from the rest of the work, the proportion and detail of its parts being out of scale with the front. Indeed, instead of the grouping of the façade leading up to the dome, it is cut completely in two by it, so that the front extending on each side has the appearance of two separate wings, an impression strengthened by the high pitch of the roofs. The architecture of the central block under the dome is a curious medley. The dome itself is octagonal on plan, the drum very wonderful in proportion and detail, the whole feature having much the appearance of an afterthought, and the front of having been divided to receive it. Why Mr. Blomfield did not give us a design in the Gothic he understands so well, instead of the Classic he does not, is a mystery unless we are to take it as a confession by the most consistent of our Gothicists that the days of the revival — for great civil buildings — are numbered, closed, shall we say, by Mr. Street's Law Courts.

Such is a general review of the several designs; what may ultimately be built is still an open question. As in some other important competitions of late, the award of the judges begins by saying that "they do not find any design which could be adopted without alteration," and having thus thrown cold water as it were on the lot, they select Mr. Collcutt's design, to be carried out with certain "modifications" vaguely hinted at under the words of "the tower and some other points." We hear the tower is generally considered too lofty and out of keeping with the rest of the design, and a dome is suggested in its place, but how far the rest of the design is involved in the "other points" it is impossible to say. Until the amended design is finally approved and published, therefore, the form of the future Imperial Institute must remain in uncertainty. It would be useless to speculate in what direction the "modifications" are likely to tend. It is much safer to leave them with the architect and the committee.

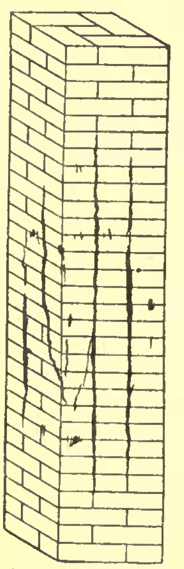
Looked at merely as a display of English architectural design, the competition is somewhat disappointing. It shows in the strongest possible manner the chaos existing in the architectural mind of the country. We may be told that to this is due the strong individuality of English architecture. Possibly so, but a great national architecture is not to be worked out by individual effort, which rushes after everything and anything in the way of style, whether it be the last new fashion in design or materials, or whether it be merely because

the "professional assessor" is well known to have practised in it, and so likely to look kindly thereon as a veiled compliment to his artistic powers. We are afraid some such tendency has been very apparent more than once of late, and we can hardly conceive any course more likely to end in feebleness or retard all progress towards a healthy national style of our own. To imitate new work of any kind simply because it is new or fashionable, instead of fostering a natural development founded on a careful study of the spirit and the letter of the historic work of our own country, seems to us hardly worthy of our position as artists, and little likely to give us great national monuments architecturally or otherwise. From this point of view the Imperial Institute designs are not very encouraging. The six competitors have given us as many different styles or phases of styles, more than one of them paying court to the latest mode. There is no unity of effort, each is like the wavelet of a lake rather than the onward sweep of the ocean tide; they break on the shore with a little fuss, but contribute nothing to the high water of thought and progress. As such, their influence on the architecture of the day can only be evanescent.

The selected design has probably more individuality about it than any of the others except Mr. Jackson's. On this account it is interesting; moreover, it is very picturesque, but it never rises much higher than this, and, being in the fashion of a day, will probably be only a subject of wonderment when the fashion has passed away. We looked for something nobler, something more elevated, something more enduring than this, something that would become not only a landmark and a guiding star in the architectural history of the reign, but a monument of the history of the Empire. The great opportunity seems in danger of being lost.

THE CRUSHING STRENGTH OF BRICK PIERS, — II.[1]

AND THE STRENGTH OF SINGLE BRICKS AND MORTARS USED IN THEIR CONSTRUCTION.



Typical Lines of Fracture in a 12″ Brick Pier.

WHERE there are few tests, or only one of a kind, extended deductions cannot judiciously be made; such differences, however, as were found to exist in the results will be pointed out, and their significance explained within what appears to be reasonable limits.

The tabulated results show the crushing strength of the piers ranges between the limits of 773 and 3,776 pounds per square inch.

The influence of the quality of the mortar on the strength of the piers is well shown in the following table:

Generally, there was a decided difference in strength between short and tall piers, the highest strength being displayed by short piers laid in strong mortar, while the least strength was shown by the tall piers laid in weak mortar. This fact shows one of the reasons why it is desirable to test piers of ordinary heights, and not base our computations on the strength of short piers alone, as by so doing we should over-estimate the strength of the brickwork in most cases.

For example, face-brick pier No. 286, 12″ x 12″ x 2′ high, laid in mortar composed of Portland cement and sand, crushed at 3,670 pounds per square inch, whereas the corresponding pier 10 feet high, crushed at 2,253 pounds per square inch, a difference of 1,417 pounds per square inch, or 188,000 pounds total. With some other piers this difference was exceeded, while on the other hand there was only a slight reduction in strength shown by 12″ pier No. 334 over the short one.

ALL 12″ PIERS 6′ HIGH.

No.	Composition of mortar.	Efficiency of pier.
		Per cent.
288	1 lime, 2 sand,	9.9
289	" "	10.6
301	2 lime-mortar, 1 Rosendale cement,	14.4
293	1 Rosendale cement, 2 sand,	17.3
300	2 lime-mortar, 1 Portland cement,	12.4
294	1 Portland cement, 2 sand,	15.7
290	Neat Portland cement,	20.8

There seems sufficient evidence, however, to establish the fact that as the height of pier increases the strength diminishes per unit of sectional area.

The highest results were obtained with the face-brick piers, both in regard to gross loads and in per cent of the strength of the single bricks. It is important that the reason for this should be clearly understood, as here we have face-brick piers laid up with bricks whose average crushing strength was 13,925 pounds per square inch, developing greater absolute strength than common piers, the single bricks of which gave an average crushing strength of 18,337 pounds per square inch, comparing now the two kinds of bricks from the yard of M. W. Sands.

The explanation of this is that the face-bricks although weaker in themselves than the common bricks were very much better in shape, their bed surfaces being nearer flat, the thickness of mortar in the joints was approximately uniform, and consequently the loads of compression were well distributed. When the bricks are of irregular shape the thickness of mortar varies considerably; at some places it is very thin, the bricks of adjacent courses perhaps almost touching each other. When this occurs in a pier laid in a weak and very compressible mortar, the loads are unequally distributed to a serious extent, the failure of some parts occur early, while the fractures progress, destroying the bricks in detail. This behavior will be more conspicuous the greater the difference in strength and compressibility between the bricks and the mortar. If both were alike in this respect we should practically have a monolith, and provided the refinement was carried farther by selecting bricks of uniform quality, the maximum strength of the material would be realized. Failure occurring as it does, in detail, the strength of the pier will not be necessarily the mean strength of its elements, as brickwork is commonly constructed.

The remarks touching upon the effect of variations in thickness of mortar in the joints are applicable to bricks with recessed bed-surfaces, and to piers and walls which are laid up of different kinds of bricks.

The common practice of laying up piers with face-brick exterior, and using the core as a receptacle for bats and odds and ends which are thrown in after the outside has been advanced several courses, or laying walls with face-brick fronts having close joints and common brick backing and thick joints, such practice does not conduce towards strength and stability of structure.

It is certainly convenient to attribute cracks in brickwork to defective foundations, and such, no doubt, is often the true cause; but it is unfair to invariably place the responsibility there when it may result from inequality in the character of the work above the foundations.

The wisdom of laying arch-bricks in strong cement, on account of the advantages gained both in strength and compressibility, is here emphasized.

The 12″ hollow piers 10′ high exceeded not only in strength per square inch, but also in gross load, the corresponding solid piers. They were laid in lime mortar. It seems doubtful whether so remarkable a difference in strength would obtain in case cement-mortar was used.

Twelve-inch pier No. 289 was subjected to repeated loadings, gradually increasing in extent; its strength exceeded somewhat that of the duplicate pier No. 288, which was at once loaded to rupture. This fact, at the time the test was made, was regarded as showing exceptional strength in pier No. 289 for the reason that the second application of a given load generally produces an increased effect on the compressibility of the pier, and it appeared quite logical to suppose that repeated loadings would first destroy the mortar and then the more readily destroy the bricks in detail. Another explanation, however, offers itself that, whereas the lime-mortar of the pier was of far less strength than the strength of the bricks, it could do little else than act as a cushion to distribute and transmit the pressure from brick to brick, and that repeated loadings, of moderate intensity, and unloadings really assisted the mortar in getting into position to serve that purpose more effectually. Here, again, the relative strength of mortar and bricks might determine which of the two explanations was the correct one for a given case.

The bricks of pier No. 292 were laid on edge. Its strength was almost identical with that of pier No. 289, subjected to repeated loadings. It is quite probable there is a slight advantage gained by laying the bricks in this manner.

The joints of pier No. 291 were broken every six courses, and this proved to be 13.6 per cent stronger that the average of piers Nos. 288 and 289 laid in the same kind of mortar with joints broken every course, in the ordinary manner.

This increased strength developed by a pier laid in a very unusual manner leads to the discussion of how brickwork generally fails. The initial cut shows the typical lines of fracture, as they appear after the maximum load has been applied, the resistance gradually falling while cracks continue to increase in numbers and extent.

Cracks first appear at the middle of the lengths of the bricks opposite the end joints in the adjacent courses, and as they increase in extent, divide the bricks into half bricks, the adjacent end joints open and thus are formed longitudinal seams. Some of the seams are parallel to the axis of the pier throughout their length, while others take this direction a short distance and thence obliquely or zig-zag towards the corners. The cracks in the bricks are, in most cases, probably the result of shearing or transverse stresses, which are caused by the uneven surfaces of the bricks and the yielding of the mortar, and not by the tensile resultant of the compression loads, as some have been led to suppose, tending to enlarge the diameter or bulge the middle part of the pier.

If the failure was by tension we should derive but little benefit from the use of strong cement-mortar compared with the actual benefits which are derived. The tensile strength of a brick being unaffected by the fact whether it is laid on bed or on edge no gain in strength would result from being laid on edge, and, furthermore, a pier laid for six courses with end joints that distance in line would be a weak method of construction on this hypothesis instead of being, as it was found, an uncommonly strong method.

These cracks, or lines of failure, frequently appear long before the maximum load is reached. This is, of course, an indication that

[1] Continued from No. 605, page 49.

failure is going on in detail, and the piers would be stronger if fractures were not developed till the close of the test, as frequently happens in the test of a cube of natural stone. The law of compensation holds true, however, in this case, as in others, for the stone which thus reaches its maximum load fails suddenly, and with a loud report flies into pieces, whereas the early development of cracks in brickwork gives visible warning that danger impends in season perhaps to avert disaster. At all events, whenever cracks appear they should be investigated, and the cause of their formation positively ascertained.

Almost, if not quite equal in importance to the determination of the crushing strength of the piers were the observations made upon their compressibility under different loads.

The data are very complete in the Government report, and should be consulted for greater detail than properly finds place in this article. A single example will suffice to show the manner of making the tests and the complete data obtained, as follows:

12″ PIER, NO. 293.

[Built of 30 courses of Bay State common brick, laid in mortar composed of 1 part Rosendale cement, 2 parts sand; average thickness of joints, 3-16″; age, when tested, 20 months.]

Total weight of pier, 740 pounds; weight per cubic foot, 123 pounds; total height, 72⅛″. Sectional area, 12″ × 12″ = 144 square inches; gauged length, 50″. The pressure gradually fell from the highest load to 240,000 pounds, when the test was discontinued. The pier was most seriously injured from the middle towards the end. Bricks in the fifth, seventh and eleventh courses from the end were partially crushed.

Applied loads. Total lbs.	Compression. Inches.	Set Inches.	Remarks.
10,000	0	0	Initial load.
20,000	.0014		
30,000	.0035		
40,000	.0058		
50,000	.0086		
10,000		.0014	
50,000	.0091		
60,000	.0116		
70,000	.0149		
80,000	.0182		
90,000	.0216		
100,000	.0249		
10,000		.0050	
100,000	.0254		
110,000	.0279		
120,000	.0313		
130,000	.0353		
140,000	.0389		
150,000	.0431		
10,000		.0098	
150,000	.0443		
160,000	.0476		
170,000	.0515		
180,000	.0566		
190,000	.0621		
200,000	.0677		
10,000		.0185	
200,000	.0694		
210,000	.0736		
220,000	.0783		
230,000	.0846		Snapping sounds, but no cracks in sight.
240,000	.0913		
250,000	.0968		
10,000		.0307	
250,000	.1013		
260,000	.1075		Longitudinal seams opened in 7th and 10th courses from end, corner of 2d course of opposite end flakes.
270,000	.1157		Seams opened in 3d to 7th courses inclusive.
284,000			Ultimate strength = 1,972 pounds per sq. inch.

In the details of the tests as above shown the compression and sets were determined within the gauged length, which distance was laid off on the upper side of the pier as it was placed in the machine for testing, and symmetrically with the ends.

From this example it will be seen that there is a recovery or restoration in length of the pier when the higher loads are released to the initial load, which were as follows:

Loads.	Restoration.	Modulus of elasticity.
Pounds.	Inches.	Pounds.
50,000	.0072	1,929,000
100,000	.0199	1,570,300
150,000	.0333	1,459,800
200,000	.0492	1,340,900
250,000	.0661	1,260,700

It is from the restoration in length, when the loads are released, that the modulus of elasticity has been computed for this and the other piers. It will be observed that the modulus of elasticity diminishes as the loads increase, thus between 10,000 and 50,000 pounds it was 1,929,000 pounds, while between 10,000 and 250,000 pounds it was 1,260,700 pounds.

If we were to compute the modulus of elasticity from the difference in restoration at 200,000 and 250,000 pounds, it would be 816,000 pounds, and this last value closely represents the elasticity of the pier working between two high loads. The reduction of modulus under higher loads is generally the case with the piers, although in several instances the modulus is comparatively uniform, and in Pier No. 289, which was subjected to repeated loading, the modulus increased under the higher loads. Thus, after a total load of 120,000 pounds had been applied to Pier No. 289, observations on the compressibility showed as follows, the compression being measured in a gauged length of fifty inches:

Loads.	Increment of compression.	Modulus of elasticity.
Pounds.	Inches.	Pounds.
10,000	(Initial load.)	
20,000	.0 71	489,050
30,000	.0066	560,090
40,000	.0052	667,740
50,000	.0052	667,740
60,000	.0047	738,770
70,000	.0043	807,490
80,000	.0042	826,720
90,000	.0040	868,060
100,000	.0039	886,220
110,000	.0046	754,830
120,000	.0049	708,620

The maximum value for the modulus is seen to be between the loads of 90,000 and 100,000 pounds where the increment of compression was .0039. The reduction in the modulus for the two higher loads is attributed to additional permanent set under those loads, which explanation is conjectural, but, nevertheless' highly plausible. The moduli of elasticity of several of the piers between the initial load and 100,000 pounds total load were as follows:

MODULUS OF ELASTICITY OF PIERS AT 50 TONS PRESSURE.

Test. No.	Kind of brick.	Kind of mortar.	Modulus of elasticity.
332	Face, M. W. Sands's,	Lime 1, sand 3,	1,122,000
334[1]	“ “	“ “	1,198,000
326	“ “	Portland cement 1, sand 2,	2,354,800
331	Common, M. W. Sands's,	Lime 1, sand 3,	789,000
330[2]	“ “	“ “	847,000
329	“ “	Portland cement 1, sand 2,	1,814,500
328[3]	“ “	“ “ “	2,367,400
288	Common, Bay State,	Lime 1, sand 3,	789,140
291[4]	“ “	“ “	860,880
292[5]	“ “	“ “	888,890
325	“ “	“ “	727,800
327	“ “	“ “	698,320
333	“ “	“ “	741,400
301	“ “	Rosendale cement 1, lime-mortar 2,	1,045,200
293	“ “	“ “ sand 2,	1,570,300
300	“ “	Portland cement 1, lime-mortar 2,	1,052,200
294	“ “	“ “ sand 2,	1,509,600
290	“ “	“ neat,	1,590,000

[1] Hollow core. [2] Hollow core. [3] Modulus for second loading.
[4] Joints broken every six courses. [5] Bricks laid on edge.

Similar remarks to those made upon the crushing strength of the piers are applicable when referring to their moduli of elasticity.

The lower moduli are found in the piers laid in lime-mortar with the soft, common Bay State bricks, although the piers built of the harder common bricks of M.W. Sands's manufacture showed nearly the same results as the Bay State bricks when used with the same kind of mortar. A somewhat higher modulus is shown by the face-brick piers, owing, doubtless, to the regular shapes of the bricks and the closer joints. The mortar having a lower modulus than the bricks, it follows that as the percentage of mortar to the bricks diminishes the higher will be the modulus of the pier as a whole. The fact that the modulus ranges from 698,320 to 1,590,000 in the Bay State brick piers laid in different kinds of mortar, and from 789,000 to 2,367,400 in the M.W. Sands's common brick piers, demonstrates, furthermore, that the quality as well as the quantity of mortar exerts a very considerable influence on the modulus of the pier.

It is worthy of remark that these piers display moduli far below those of wrought-iron and cast-iron posts, and on the average even below that of yellow pine wood lengthwise the grain, which posts may be regarded as the competitors of brick piers from a structural point of view. The following are ordinary values of the modulus for the material of these other kinds of posts:

Wrought-iron	27,000,000
Cast-iron	16,000,000
Yellow pine (*Pinus Palustris*), average of 25 specimens	2,116,000

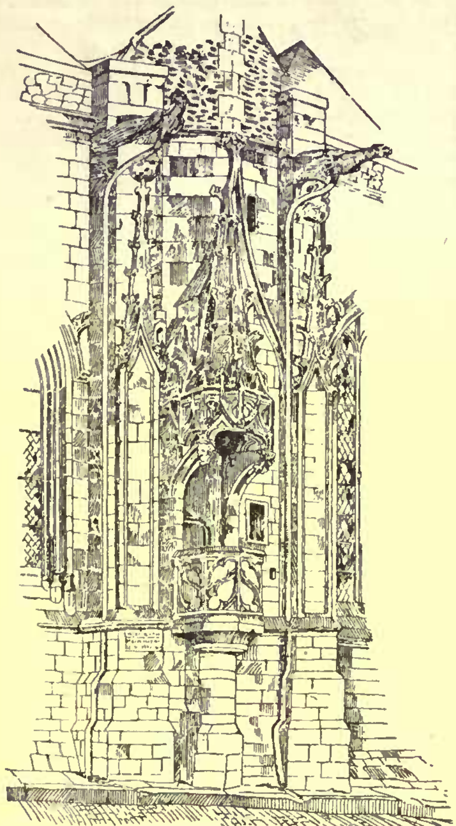
Some modification in the values of the modulus might be expected in case the piers had been subjected to superimposed loads before the mortar had set, conditions not uncommonly met with in practice.

Hitherto we have been regarding the elasticity of the piers divested of all permanent set, and in the modulus of elasticity have a measure of this elasticity. In addition to the elasticity thus displayed, each additional load, generally speaking, produced a permanent set. With low loads and strong mortar in the pier, the permanent sets were of small magnitude compared with the elastic part of the total compression of the brickwork. The ratio which the permanent set bears to the total compression extends over wide limits, being in some instances less than ten per cent, and in other cases rising to over eighty per cent of the total compression, the lime-mortar taking the responsibility for the higher percentages. As previously stated, the quality of the mortar gives character to the brickwork in the several physical properties developed. Under loads nearly approaching the ultimate strength, the total compression ranges in amount from one-tenth per cent to one and two-tenths per cent the height of the pier.

JAMES E. HOWARD.

THE GROWTH OF HARD WOODS.— Cultivated in groves, the average growth in twelve years of several varieties of hard wood has been ascertained to be about as follows: White maple reaches 1 foot in diameter and 30 feet in height; ash, leaf-maple, or box-elder 1 foot in diameter and 20 feet in height; white willow, 18 inches and 40 feet; yellow willow, 18 inches and 35 feet; Lombardy poplar, 10 inches and 40 feet; blue and white ash, 10 inches and 25 feet; black walnut and butternut, 10 inches and 20 feet.

THE PRESERVATION OF ROME.



EXTERNAL PULPIT NOTRE DAME ST. LO.
AFTER A DRAWING BY MR. F. D. BEDFORD IN THE BUILDER

THE following interesting account of the project for the reservation of a space of ground to be sacred to the antiquities remaining in Rome is from the pen of an occasional correspondent of the *Glasgow Herald:*

If a mere walk in an observant spirit through a gallery of renowned paintings or of celebrated statues furnishes material for thought almost tantamount to a liberal education, as some hopeful persons assert what may not be hoped from the new archæological promenade proposed for Rome? Signors Bonghi and Baccelli, both ex-Ministers of Public Instruction, and bitter political opponents one of the other, have sunk their differences for the nonce to work together in devising a project of law or a Bill the object of which is the construction of a promenade embracing the more remarkable ruins of Rome in its circuit. Should such a project be accomplished, such a promenade might furnish vivid illustrations to, and opportune commentaries on, the course of classical studies that have been pursued by every intelligent visitor who would thoroughly comprehend ancient Rome.

The extraordinary increase of population during the last dozen years in the city of Rome has, of course, necessitated the construction of new streets, and, indeed, of complete quarters, whose combined bulk almost equals that of the ancient city. This increase has seriously threatened some of the old monuments, and occasionally, greatly to the grief of archæologists and students of history, some quaint old landmarks have been overthrown and destroyed, or turned to account in this new march of civilization. As in the days of Sir Thomas Browne, "mummy is become merchandise, Mizraim cures wounds, and Pharaoh is sold for balsams." Discoveries of antique remains, if not of preëminent interest, made during the preparatory labor for the construction of new streets were drawn and described, and then left to the mercy of the house-builders. This is an old story in the history of Roman remains. The late Charles Heath Wilson, so long associated with art in Glasgow, in his excellent life of Michael Angelo, records a similar catastrophe, and the great Florentine made a "sharp attack upon Bramante for his irreverent and scandalous destruction of the ancient columns of the Basilica of St. Peter's." And Raphael, when appointed by Leo X as superintendent of ancient remains, found, to his great sorrow, that many fair monuments were destroyed, "as the Meta, the arcade and the entrance to the Baths of Diocletian, the Temple of Ceres in the Via Sacra, a part of the ruins of the Forum, burned a few days ago, and the marbles of which have been converted into lime" (!) The same spirit prevails still, which in the olden days drew from Pasquin the bitter reproach against the Barberini family, accusing them of having done what even the barbarians had not done — *Quod non fecerunt barbari fecerunt Barberini.* Nevertheless, of cities as of human beings, the proverb holds good that suffering is the penalty to be paid for artificial beautifying — *il faut souffrir pour etre belle.* If Rome has not improved much in beauty — and artists say it is uglier than most modern towns — it has at least followed the fashion of the age, and has grown larger and been more replastered and stuccoed and whitewashed.

The remnants of the old city, the ruins and monuments which are found here and there on the line of way encroached upon by the modern builder — the poor unprofitable fragments of ancient architecture, which, according to a recent description of them by Mr. Sala, seem to have been earthquaked many times — are what Messrs. Bonghi and Baccelli would save from extinction or further destruction. Baccelli has deserved well of all students of ancient Roman history and archæology. When he was Minister of Public Instruction, he, at considerable cost, disencumbered the Pantheon of the groups of unsightly buildings that in the course of ages had grown up against its rounded side like limpets on a rock. It is to his persistent exertions that the world owes the discovery of the Rostra and the House and Atrium of the Vestal Virgins, as already noted in these columns. His present purpose is to save the remains already discovered from the encroachments of that daylight spectre which stalks through Rome, and which, unlike to Banquo's ghost, has speculation in its eyes and also in its soul — the modern speculative builder. He has as little heed of the antiquity and associations of ruins as a railway-engine has for the beauties of the landscape it passes through.

In the report just presented to the members of the Italian Parliament by these two ex-Ministers, the preservation of the monuments or remains existing on the track of a zone or belt of land in the south of Rome, defined by them, is what they seek to accomplish. Such preservation they consider will be advantageous not only to students of history and archæology, but also as a means that may be employed for the education of the people at large. The duty which Italy ought to fulfil in respect to such a task is contrasted with the work which France has accomplished, maintaining for close on forty years a school of archæology at Athens; with the work of Germany, which, as far back as 1829, established in Rome the Institute of Archæological Correspondence, whose earliest directors were the able Gerhardt and the renowned Bunsen, as its latest was the profound archæologist and most estimable gentleman, William Henzen, and which nation has also founded in Greece a school to which archæology owes the splendid excavations of Olympia; with that of America, which has a permanent archæological mission at Athens, and is preparing to establish a similar one in Rome; even with that of Russia, which seeks traces of ancient Greek cities on the littoral of the Black Sea; and of Turkey, which has gone so far as to order the making of excavations for archæological purposes in her provinces of Asia Minor.

It is a necessity of the modern spirit, say Baccelli and Bonghi, to turn to the past — to the art of Greece and the civilization of Rome. "Rome was always universal," continues the report. "It had, by its pristine valor, universality of conquest; in the Middle Ages it had universality of faith; it has, and it cannot but have, in our days the universality of a nation." It may appear to less fervid enthusiasts than the writers of this report that "the universality of a nation" is rather a come-down for a city which has had previously universality of conquest and of faith. Probably it is to support this assertion, which is rather limited in scope, that the writers continue: "At its apogee in arms, government, science, and art, how many of its great men were born at Rome? At the epoch of Julius Cæsar — a Roman by birth — Horace was from Venosa, Virgil from Mantua, Cicero from Arpino, Catullus from Verona, Propertius from Assissi, and so on through an indefinite series of examples; but all were, and felt themselves to be, Romans." History repeats itself. All Italians are Romans by right, says the report, in rather too general and generous a manner, "and may, by desiring it, become so in fact at any moment, and that without diminishing or offending their love for their native place." If all Italians are Romans by right, it seems a wanton waste of effort to have them again become so, even in fact.

The space, or zone, which these ex-Ministers would turn into an archæological promenade, with ancient monuments for the study of the traveller or the student, or for the contemplation of the Roman of an afternoon — a temple, a circus, a bath, or a tomb on either hand — is a space that is described by competent authorities as unhealthy, and therefore a site wholly unsuitable for dwelling-houses. By the adoption of this Bill the insalubrious land would be utilized and converted into genial retreats, shaded with avenues of stately trees, in which the poetical imagination might dwell on the vanity of earthly greatness as the eye rested on a nameless tomb, and which the archæological memory might fill with togaed sages and armed warriors such as one may see in the paintings of Alma Tadema. In old times Greece had its philosophy of the Porch; if the new project be carried out Rome will have its archæology of the Grove.

The length of the proposed promenade is eight kilometres, or about five miles. Embracing the Forum, with its remains so sadly suggestive of ancient beauty and harmony of construction; passing round the Basilica of Constantine, and thus sweeping away the unsightly and malodorous streets in that neighborhood; skirting by the Colosseum, which, if building goes on, may lose its special charm of isolation; proceeding under the Palatine Hill, with its remains of the Palace of the Cæsars; embracing the huge ruins known as the Baths of Titus, and even sweeping around the Baths of Caracalla, and furnishing a point of view unimpeded by the high walls and the vineyards which now encompass that magnificent monument of Imperial greatness, the new promenade would be lengthened out until the various sites whose history has rendered Rome a world-wide name would be embraced within its circuit. It is unnecessary to follow it in all its windings. There are few, indeed, of the historical or more important ruins which would be omitted from its saving and protecting scope. One may imagine — although it is difficult to appreciate in all its fulness — what the value of such a promenade, bringing together in an accessible manner these remains of a past civilization, will be to the student, the archæologist, the learned historian, or even the simple and hurried tourist; and there are few who will refuse to praise the project of Bonghi and Baccelli, and wish it a successful fulfilment. The new promenade would be situated almost in the centre of the Rome of to-day "as a gem is fixed in a ring of gold."

The authors of the project refer to the "cry which was raised in Europe against the so-called destruction of Rome," and they intend to show the people that the representatives of the nation and the

King's Government are profoundly conscious of their duty and of "the high destiny to which the Rome of the Italians is called." It is well and very natural that these should repel the charge of destroying Rome; but even the present effort, which may or may not be successful, to save or at least to isolate the great remains from the danger they now run of being discovered some future day in the middle of a modern square or at the back of a new street — or, like the inscribed arch of the aqueduct in the Via Nazzareno, down beneath the soil in a narrow, well-like cavity — is the outcome of the feeling that the ruins of ancient Rome are not likely to be carefully looked after. If it is not immediate destruction, the authors of the report fear it is profound neglect and indifference, the effects of which are likely to be destructive. The very cry that they now utter — their appeal to save — is but the echo of the cry uttered over a year ago by Hermann Grimm, Ferdinand Gregorovius, and the other artists and scholars, lovers of Rome and of its antiquities, who complained of the destroying then going on.

If Baccell and Bonghi succeed in getting their Bill passed, and the Parliament vote the forty millions of francs required for the work, they will lay the students of the world under a deep debt of gratitude.

BOOKS & PAPERS.

PHOTOGRAPHY has, to a very great degree, annihilated the art of sketching as it was formerly practised by travelling architectural students, but there are still enough left who know how to use the pencil to make a very appreciable impression on the character of the illustrations in the professional journals by the publication of the memoranda collected during their vacation trips. The pocket sketch-book is more familiar to the hand of the English student than to students of other races: that is, if it is fair to draw an inference from the great number of published collections of sketches made by Englishmen, and the comparative rarity of similar collections made by students from any of the Continental nations.

Sketch everything and sketch always is quite likely to be the stock advice given by any English architect to his articled pupils, and it is good advice, and seems to be followed admirably. Unfortunately for American architectural students, they are not surrounded by those tempting invitations to sketch which the masterpieces of past ages offer in all the older countries, and it must be a rarity indeed to find an American sketch-book filled with sketches of American architecture. Unless an American chances to visit Europe he seldom learns to sketch; but none the less is he an appreciative observer, and values such publications as this[1] that the Edinburgh Architectural Association issues quite as much as those who have a personal familiarity with the subjects depicted.

The feature that distinguishes this from other similar sketch-books is the publication of a short description, historical and architectural, of the subjects of the several illustrations. On the whole, we are surprised to find how little these notes add to the proper value of the work; not that the notes are not adequate or well written, but somehow a brief description of an architectural subject can rarely be made interesting; the real interest that centres about a building belongs less to its fabric than to those who have dwelt within its walls, and after giving a bald statement of the date of its construction, the material of which and the style in which it is built there can be very little more said about most buildings without drawing more or less upon the store of human incident which vanished lives have gathered about it. For all its greater ability to withstand the attacks of time the inanimate mass, to be interesting, has to rely on the deeds and sentiments of the comparatively ephemeral human being.

Scottish architecture is unlike any other; it is simple, robust, but not unrefined. It seems to have taken its inspiration direct from over the sea and not, as might be supposed, by slow transfusion from the southern end of the island. In fact, at the time when Scottish architecture was forming its distinctive features there was so much hostility between Gael and Southron that it is doubtful whether either one or other had opportunity to study his neighbor's methods till he found leisure, but a limited field of observation, within dungeon walls. Thanks to the difficulty of earning a living in his own land and to his adventurous spirit and bodily strength, the Scotchman, like the Switzer of the same epoch, saw much of other lands in Continental Europe in the guise and uniform of the hired mercenary. Flanders and Normandy were particularly familiar to the Northern adventurer, and if he succeeded in securing enough of booty to enable him to return to the land of oatmeal and haggis it was only natural that he should build his new house in as close resemblance as he could to those foreign buildings that had attracted his wondering youthful admiration. The baronial architecture of Scotland we take to be the result of service under the white flag of Louis, while the peculiar and characteristic town-house, as seen, for instance, in Edinburgh, is probably a reminiscence of Low Country cities where he was quartered while upholding the banner of Charles the Bold. We do not mean that any of the subjects of these plates owe their being to these martial wanderers, for their foundations lack a century or so of the necessary age, but their type is too uniform not to be the culmination of many stages of endeavor, progressing from the crude idea brought home by some free-lance or *lanzknecht* and wrought into crude shape for him by some monkish freemason.

It strikes us that with the possibilities Scotland affords these plates might have been more interesting, but it is possible that they partake of the nature of inedited remains, and that the three preceding volumes of the first series — this being the first volume of a new series — to say nothing of all the other sketch-books that have been published, contain much more attractive material. The Committee of Management seem to have organized the operations of the Association with some definiteness of purpose, and we may infer that members were instructed to direct their observations last season upon plaster ceilings, for we find nearly a quarter of the plates devoted to delineating a fairly-interesting series of ornamental ceilings, which probably possess much more richness and decorative effect in reality than they do on paper.

We notice one rather curious and "knowing" device practised in one of the drawings of the tower of the Chapel of King's College of Aberdeen University. It is in a sectional drawing of the "crown" which is similar to the well-known crown of St. Giles at Edinburgh. The section is taken on the diagonal, so that two of the supporting buttresses which support the hanging crown, are shown in orthographic projection, while the buttress on the axis of the drawing, instead of being shown in projection, is drawn slightly in perspective, and so materially helps the intelligibility of the drawing. The plates which illustrate this chapel are almost the best and most architectural of any in the collection; most of the others are either overwrought and "niggled" to the last degree, or are crude and raw in execution.

[1] "*Edinburgh Architectural Association Sketch-Book,*" 1883–1886. Vol I, New Series. Printed by George Waterson & Sons, Edinburgh and London.

SOCIETIES.

ARCHITECTURAL LEAGUE OF NEW YORK.

THE programme for the second Midsummer Outing has been arranged as follows: Leave New York August 18 by Fall River boat at 6.15 P. M., for Newport. In the early morning, after coffee, there will be a trip to the beach in carriages, which will be at the service of the party all day. After a bath in the surf, breakfast will be taken at the Aquidneck. The balance of the morning will be spent in a drive to some of the best houses in Newport and an examination of the interiors of a few of them, including Mr. Cornelius Vanderbilt's and Mr. Robert Goelet's houses. Lunch will be had at the Casino, and the party will take the afternoon train for Boston. The headquarters in Boston will be at the Parker House, the dinner there on the evening of the 19th being a regular League dinner. On this occasion, beside the Boston members of the League, there will be present invited guests from the leading members of the profession in Boston. On the morning of the 20th there will be a drive around Boston and out to Brookline, with inspection of noted exteriors and interiors. About noon the party will take train to North Easton, where all the famous Richardson buildings, including the Ames gate-lodge, will be inspected from without and within, through the courtesy of Mr. Ames. The return to New York will be by Fall River boat on the evening of the 20th.

The entire necessary expenses of the trip to each member, including passage both ways, state-rooms, hotel-bills, carriage-hire, all meals, etc., will be in the neighborhood of twenty-five dollars.

In order that the Committee may conclude proper arrangements, it is absolutely necessary that acceptances for the above trip should be received by F. A. Wright, 149 Broadway, on or before August 9.

By order of the Committee on Current Work.

F. A. WRIGHT,
EDWARD H. CLARK,
JOHN P. RILEY.

COMMUNICATIONS.

THE GRANT MEMORIAL COMPETITION.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — Would you, or one of your numerous readers, give me any information anent the following excerpt from *American Architect* of June 25:

"The announcement of the Grant Monument Association, that it will receive designs for a memorial to General Grant, unsatisfactory as it is, shows that between now and the end of October," etc.

Was the announcement made by advertisement? In what paper did it appear, as I have missed it if it was advertised in the *American Architect?* Who is the Secretary of the Association?

Oblige yours, etc., RIP VAN WINKLE.

[IT is only one more instance of the peculiar manner in which the Grant Memorial Association is managing its trust that the advertisement of the proposed competition was inserted in the New York daily papers in June last. We have not noticed that the advertisement has been published in any professional paper — to which architects naturally turn for such information. Richard Greener is the Secretary.— EDS. AMERICAN ARCHITECT.]

NOTES & CLIPPINGS

The Cellerier-Parkes Photographic Process.—The brief interest that was raised some short time since, by the announcement—founded on misapprehension—that a process had been invented of securing natural colors by photography, has died away, and the real foundation upon which so fanciful a claim was reared appears to have sunk out of sight, and to be replaced by the very practical Cellerier-Parkes process, which has already established its claim to be regarded as a highly-ingenious and successful application of some of the later developments of photography. It is based upon the carbon process, which, though old of itself, has been lately perfected so far that permanent sun pictures can be produced with rapidity and certainty. Told very briefly, the carbon process consists in the exposure behind a negative of a sensitized-gelatine film, containing finely-divided carbon, or other suitable pigment, and mounted on paper from which it can be subsequently stripped on immersion in warm water. The bichromate of potash, or other sensitizing medium, renders the gelatine more or less insoluble, according to the energy of the light falling upon it, and which is, of course, regulated by the negative. After exposure, the film is laid upon glass, and is placed in warm water, when the paper backing comes away, the superfluous and soluble gelatine is washed out, and the definite picture with all its light and shades determined by the thickness of the pigmented gelatine film is left behind. When dry, this film is so thin that irregularities on its surface are inappreciable. The film is afterwards stripped from the glass and mounted on a suitable permanent support of paper. So far, this is an old and well-known process, and the Cellerier-Parkes development commences with the treatment of the permanent-paper support, which, previous to being attached to the picture, is held in contact with it temporarily, while it is still attached to the glass. The operator, for whom great skill is not necessary, is able to see the picture through the paper by transmitted light, and covers it with flat washes of suitable colors, but of a stronger tone than would be desirable for the finished work. This paper is then detached, the carbon film is stripped from the glass, and the face which was in contact with the latter, is carefully laid to register with the colored washes on the paper. The film and paper are then brought into intimate contact, subjected to a steaming process, and by this means they are thoroughly cemented. The colors laid on the permanent support are then seen through the carbon film, much softened and subdued, all the lights and shadows being produced by the pigmented carbon. The art of producing colored photographs can scarcely be carried much farther than by the very simple means of which we have indicated the outlines, and which are equally adapted for landscape-work and for portraits, as a visit to the Cellerier-Parkes studios in the Pall Mall or the Poultry will show. The process appears, in fact, to be another step in popular art-education which has made such prodigious strides of late years.—*Engineering.*

Test of Refrigerating Apparatus.—The approaches to the suspension-bridge connecting New York with Brooklyn, N. Y., are immense masonry structures, which some utilitarian individual has further put to good service by closing the arches at either side and converting the rooms thus formed into cold-storage warehouses for the purpose of keeping articles which would be perishable at the natural temperature. This system of refrigeration is based upon the volatilization of anhydrous ammonia, and the heat absorbed in this evaporation of the ammonia chills a solution of chloride of calcium, which circulates through pipes in the warehouse, and reduces the temperature by direct absorption of the heat radiated towards the pipes. These refrigerating machines were installed under a contract guaranteeing that each one should have the capacity of absorbing, every twenty-four hours, a quantity of heat sufficient to melt 40,000 pounds of ice. The question of their conformity to the specifications was referred to Messrs. Collingwood, Martin and Abbott, all members of the American Society of Civil Engineers, and they found that each machine possessed a refrigerating capacity equivalent to the melting of 43,595 pound of ice, or nine per cent in excess of the contract. The weight of the solution used was 73.48 pounds per cubic foot, or 1.16314 specific gravity, and its specific heat was found by experiment to be .827. The brine was measured by a water-meter, and differences in temperature indicated by a thermometer. They avoided a frequent and inexcusable error by ascertaining the specific heat of the solution by actual experiment instead of assuming it to be unity. There it no statement made relative to the kind of thermometer used, but for low temperatures alcohol would be superior to mercury thermometers. The efficiency of the apparatus for twenty-four hours was found by adding the products of the cubic feet of brine circulating through the pipes by the corresponding differences in temperature in the ingoing and outgoing currents of brine as observed at frequent intervals, and this sum was multiplied by the specific heat of the brine (.827) and its weight per cubic foot (73.48), and the final product—applying all allowances for corrections from various causes—amounted to 6,218,816 heat units as the amount abstracted in twenty-four hours. According to the determination made by Dessains and De la Provostape, 142.65 British thermal units are necessary to melt one pound of ice, and therefore this apparatus has a refrigerating capacity equivalent to that produced by 43,565 pounds of ice in twenty-four hours. This result was accomplished by the combustion of 2,000 pounds of coal under the boiler operating the pump condensing the anhydrous ammonia vapor. If this coal possessed a theoretical calorific value of 13,500 heat units per pound, the total amount of energy of combustion in twenty-four hours would be $2,000 \times 13,500 = 27,000,000$ heat units, and the result of the process of transformation of energy was, as already stated, 6,218,816 heat units, showing an efficiency of twenty-three per cent, which is certainly very high in comparison with other methods of transformation of energy in connection with prime movers; and it is safe to assume that it would be practicable to increase this ratio of efficiency with a plant on a larger scale.

It may be remembered that the address of Octave Chanute, C. E., vice-president of the Mechanical Science of the American Association last year (noticed in *Engineering*, Oct. 1 and 15, 1886), stated that, as a matter of practical operation, refrigerating-machines would accomplish as much with the combustion of one pound of coal as with 20 pounds of ice.—*Engineering.*

Temple Bar.—The London correspondent of the Manchester *Weekly Times*, speaking of Temple Bar, which formerly marked the city boundary in Fleet Street, London, says: "'Out of sight, out of mind.' This familiar saying is not applicable to the stones of Old Temple Bar, an ancient monument rich in historical association, which was removed ten years ago. For some years these stones have been hidden away, but although concealed they have not been forgotten. At intervals enthusiasts and antiquarians have pressed the question of the desirability of reërecting the Bar at a part of the city where its site would be more suitable than at the end of Fleet Street. The Corporation hitherto have paid little heed to the representation on the subject, our economical rulers always urging the absurd obstacle of the expense. What these authorities have grudged doing, Sir H. B. Meux is willing to undertake at his own charges, on condition that he is permitted to reërect the Bar at the entrance of Theobald's Park, Chestnut. The acceptance of the proposal was recommended by a large majority of the members of the City Lands Committee; but a common Council, some of whose members are in favor of the monument being erected in a place of public resort, have sent back the proposal to the Committee with instructions for further consideration, and with the broad hint that 'so memorable and historic a structure as Temple Bar' must not be lost to London. The cost of reërecting the monument is estimated at £1,700, and this sum Sir Henry Bruce Meux is prepared to pay himself."

A large Oil-Tank.—An immense iron reservoir is now being erected in the outer harbor at Amsterdam for the storing of oil. Its capacity is upward of 1,740,000 gallons. The petroleum will be brought to the tank and pumped directly from tank-ships especially constructed for this service. By so doing all expense for barrels is done away with, besides the reduced cost of handling and greater safety.—*Iron.*

TRADE SURVEYS

Every successive industrial railroad or financial tabulation of results exhibits a more comforting trade condition. Even giving the unfavorable features, so industriously pointed out in some quarters, the very fullest consideration, there is no good ground for drawing in our lines or preparing for a reaction. The excess of production this year over last in iron, steel, fuel, lumber, petroleum, textiles, building-material, hardware, railroad equipments and appliances, and, in fact, in all manufacturing and producing channels is general and sufficiently large to create and strengthen confidence.

The posting of the comparative statistics in all these branches might possess special interest to the lovers of tabulated results, but the moral to be drawn from them is one, viz., the increased producing and consumptive capacity without trade congestion or feverishness. That is to say, consumption is close upon the heels of production, and production is straining its energies in a wise way to increase the supply. The steel-rail makers met this week at Long Branch and considered the condition of that great industry. Prices are now $37 to $40, according to date of delivery and size of order. The syndicate agreed to start in with 800,000 production for 1888. This resolution means nothing. It is merely a notice to consumers that when demand does eventually fall off that competition will be checked so that remunerative margins will be preserved. It is probable that producing capacity will reach 2,500,000 tons for 1888 at its normal power. Railroad construction is now being pushed in earnest. Several large deliveries are arranged for, to be made on the Gulf and Pacific coasts. Large sums of money are to be expended for machinery this year and next to extend mining operations in the West, between the extreme North and the extreme South mining regions. Another item of interest to be noted is the large lumber purchases made for delivery all over the country. Lumber operations, next to iron, are indicative of the strength or weakness in trade movements. The picking-up of valuable lumber tracts continues wherever they exist, and the contracts placed within two months for fall and winter delivery are double those of any former season. Another favorable feature is the high earning capacity of recent investments. Capitalists find very little to discourage them. The farmers and cotton-planters have excellent crops. Cotton is high. Europe wants larger quantities of it than last year. Wool is wanted, and is far from being in over-supply. With all the increase in iron and steel making, consumers have placed large orders ahead, and besides are making large draughts on foreign sources. Building activity has abated a little, apparently in some localities, but it is not a true sign. The contracts out for building material disprove the statement that there will be any decline in building throughout the country. The saw and planing mills are loaded up. Hardware factories are crowded. Wagon and tool works are busy. The industrial activity throughout the West is particularly encouraging, and new industrial capital is finding safe employment there. The general improvement in the Southern States is stimulating industrial and railroad enterprises in the Ohio Valley. This fact has been referred to before, but there is a sufficient multiplication of new enterprise in that locality to justify another reference. Eastern shops have had much new business from this region.

Wood-working-machinery makers have, within a month, closed an immense amount of fall and winter business. Both Eastern and Western brick-makers are enlarging their facilities. Car-builders are doing the same. The railroad equipment and supply demand will be almost phenomenal during the coming twelve or eighteen months. Shop and factory equipments are being almost revolutionized. Small old-style machines and machinery are giving place to newer and heavier power. A very large percentage of fifteen-year old machinery and appliances are going out, forced out by economic agencies, and the replacement in progress is creating an enormous demand, the full force of which will not be seen and felt until after the opening of next year. Even should railroad-building collapse, other supporting influences are coming up, and will broaden our industrial foundation.

THE AMERICAN ARCHITECT AND BUILDING NEWS.

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CONTENTS

FIRE AND WATER seems to have experienced a little change of heart, or, let us say, to have returned to its usual fairness, in regard to the influences which control the construction of buildings, and in an earnest editorial on the "Responsibility for Heavy Fire Losses," which we find in its issue of July 2, it has not a word to say against architects, while it speaks of the bad effects of modern insurance methods with a frankness and severity which we have never before met with in the American technical journals. The occasion of the editorial seems to have been the enormous losses by fire which have recently occurred all over the country, and especially in New York. Although, when the article was published, only one-half the year had elapsed, it is said that the losses of some of the companies in New York city which confine their business to local risks had already amounted to more than double the premiums received, so that, even if they should have no losses whatever during the remaining six months, the net result of the year's business would be a deficit; and the companies doing a general business are not much better off. In trying to account for these terrible losses, *Fire and Water* points out with great force that the discipline of the New York Fire Department, once the best in the world, has been so mismanaged as to destroy much of its efficiency, apparently through a stupid and ridiculous parsimony on the part of the politicians in charge of it. It appears that orders have been given to avoid calling for extra assistance in cases of doubt, and a year ago an Assistant-Chief of the Department was dismissed the service because, at a serious fire, he signalled for additional help when, as his superiors, who were not at the fire, imagined, there was no need of it. It is needless to say that the subordinate officers, encouraged by this example, hesitate a good while before they venture to risk their official heads by summoning extra help, and during their moments of doubt the fires which they are trying to extinguish often become uncontrollable, even by the additional force which is summoned too late. There were ninety-four fires in New York in one day this year, — the fourth of July; and the spread in the Fire Department of a hesitation in dealing with conflagrations, and a dread of taking any responsibility, such as is the inevitable result of punishing so severely an exercise of the proper discretion of an officer, threatens the most serious consequences to the city. As *Fire and Water* well says, the law provides that the officer in command at a fire shall use his best judgment in managing it. If he does this, he fulfils his whole duty, and is not liable, either in law or justice, to any reprimand or punishment whatever, even though his judgment may, like that of every one else, be occasionally mistaken. As his experience enlarges, his judgment will become more sure, and those who know more about putting out fires than he does may advise him, if he is willing to listen to their advice; but so long as a man is in charge of a given service, nothing but neglect of his duty can form a just ground of reproach against him, and least of all should he be punished for an excess of prudence in a duty where prudence is notoriously the only safeguard.

OUTSIDE of the discipline of the Fire Department, *Fire and Water* considers that the underwriters "must take a large proportion of the blame" for the heavy losses that have occurred this year. "By the methods," it says, "which they have pursued during past years, the property-owners have been induced to erect immense insecure structures and fill them with highly inflammable material without protest from the insurance companies." "No matter how bad the risk, companies can be found that will insure it for its full value, and it is a well-known fact that the greater the hazard the more anxious is the owner to keep fully insured." We would like on our own account to add another observation to this, to the effect that the insurance companies, while they insure these structures at rates which they know to be inadequate to the risk, and without a pretence at inspecting them to see if they cannot be made a little less dangerous, take advantage of the ignorance of the public in such matters to charge enormously profitable rates on the better risks, so as to bring the average up to a remunerative rate, although by doing so they simply rob the prudent, conscientious owners, to reward the unscrupulous speculators who, by playing one agent against another, know how to get the cheapest insurance on their flimsy structures. "Instead," *Fire and Water* goes on to say, "of striving to improve the character of the structures in the city, the underwriters virtually offer a premium for inflammability and poor construction." This is almost a literal repetition of expressions which we have seen both in English and French journals, but the insurance companies have as yet shown only the feeblest consciousness of what is beginning to be the widespread opinion of their course. Here and there an underwriters' association has some rules printed and distributed, and in New York for some years a faithful and efficient officer looked out for the security of construction, much to the advantage of the companies which he represented; but these efforts are soon relaxed, and the business relapses into its old condition. Then heavy losses come, and the underwriters wake from their sleep, and begin to bewail themselves, and berate the architects, who really, by the pains which they take to supervise the work under their charge, and the good principles of building in which they are trained, probably save to the underwriters every year a sum larger than the united income of their whole profession. As we have often said, if the underwriters cannot protect themselves against losses by inflammable construction, no one else can do so. The whole system of building is practically in their hands, to change or direct as they will. If they choose to insure goods in battened sheds at the same rates as those in fireproof buildings, they may be certain that the goods will soon be found in the sheds; and if they should refuse to insure anything not contained in fire-resisting structures, a few months would see all mercantile buildings transformed. In any efforts which they might make toward the improvement of construction, not only architects, but the best builders would help them earnestly, but it is useless to expect either architects or builders to do the work against the enormous inertia, or rather, the positive opposition of the insurance interest. Not long ago we had the honor of being consulted in regard to converting a large building into a fire-resisting structure by the simplest efficient means. It was a building where no money could be afforded for the gratification of a whim, and after calculating the approximate expense of the wire lathing and fireproof partitioning, we inquired the cost of insurance on the building in its actual condition. The premium paid on the building as it stood was only a fraction of the interest on the cost of transforming it, and we considered it our duty to point out that the wisdom of the underwriters had made the proposed change financially very injudicious, and the idea was accordingly abandoned. With people who have to direct the investment of large sums of money, for themselves or others, this sort of calculation is an everyday experience. So far, most of the

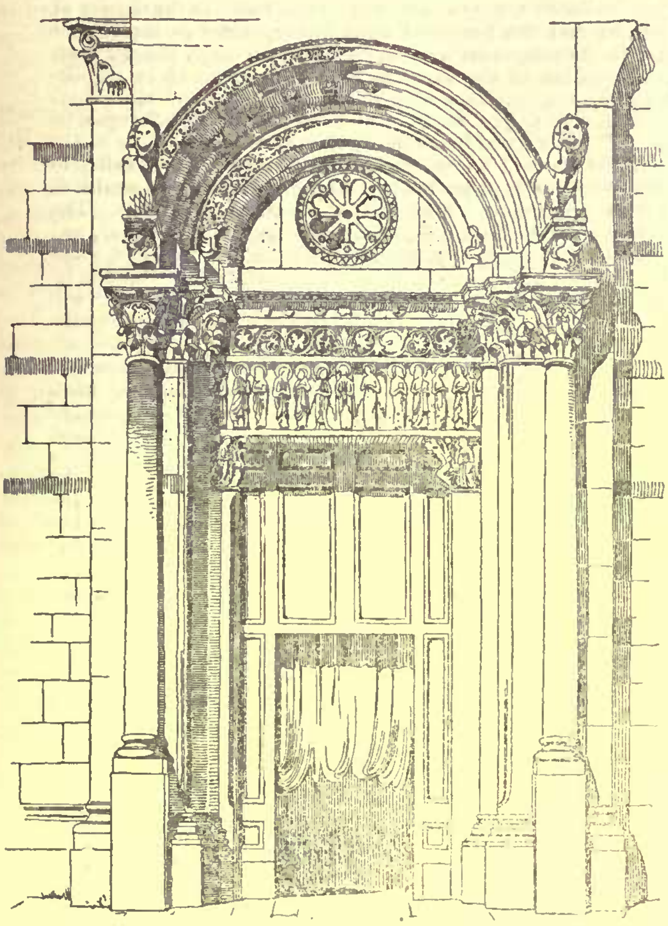
efforts to make the cost of a fire-resisting construction approximate the capitalization of the insurance premiums saved by it have been made by the mill mutual companies and the architects, and they can do no more. If the underwriters wish to have fire-proof building become more general, they alone can make it so.

It is hard to avoid a certain suspicion that the Knights of Labor, or rather, their managers, have their eye on the railroads, as the vulnerable point of the business and public interests of the country, through which they can, later, when the time arrives for their grand *coup*, do so much mischief, and cause so much unhappiness as to bring themselves again into prominence, and possibly into power. The beginning of a course of interferences with the affairs of the roads and the public, which, if we are not mistaken, will, on one pretext or another, be continued, seems to be found in a ridiculous squabble about certain tests applied to firemen and brakemen on the Philadelphia and Reading Railway. Under the present system of conducting railways, where the safety of trains and passengers depends absolutely on the correct reading of signals, and the understanding of the printed directions issued to the men concerned in running trains, it is not unnatural that the idea should have occurred to some one that life and property on railroads would be safer in the hands of men who could distinguish a red light from a green one, and who had education enough to read a time-table, than of those who did not possess those qualifications. Once suggested, the propriety of the notion was so obvious that it was soon adopted in nearly all places where railways are in extensive use, and the laws of several of our States, to make sure that the railway managers shall not endanger the lives of the public, direct the examination on these points of all persons engaged in railroad service. Following the example of others, the officials of the Philadelphia and Reading road decided not long ago to test the fitness of their men for running trains by means of printed directions and colored signals, and set two intelligent officers at work to conduct an examination. One of the first persons examined was the engineer of a night passenger train. On being shown a pile of skeins of worsted of different colors, and being asked to pick out the green ones, of which there were seven, he found only one green one, and chose white and slate-colored skeins for the others. On being asked to choose the pink skeins from another pile, he picked out four blue ones, one brown, and three green; while he chose the same skein twice, once as a red, and again as a green. It is tolerably obvious that a man with eyes like this, however valuable in any other capacity, is not just the person to run an express train every night over a track where there is nothing but the block signals at every mile, showing red for danger ahead, and green for safety, to keep him and his passengers from a dreadful death; and on the examiners' report he was given another place, of less responsibility. An order was then issued that all employés of the road having anything to do with signals should report for examination; not for discharge, in case they were found deficient, but for determining their qualifications for one post rather than another. Much to the astonishment of the officials, the Knights of Labor, who had some hold over many of the men employed by the road, hereupon interfered, and immediately called out the freight men and coal-handlers at Port Richmond, an important point on the line, until the order should be revoked. Not wishing to plunge into a conflict, the officials suspended the order, and work was resumed, while a conference committee met to deliberate upon the matter. At last accounts this committee, being composed, apparently, of sensible men, was discussing it amicably, and with a prospect of reconciling the men to an idea which has been carried out on other railroads, and even on another division of the same road, with much satisfaction to all parties; but in the local meetings in different places along the line, where the loudest speakers carry the day, demands were made for the immediate discharge of the Superintendent and Assistant-Superintendent of the road, together with other officials; while the cause of the engineer who thought the red and green worsted looked alike was also taken up, and "justice" invoked for him. Whether this sort of talk is mere idle vaporing, or the work of persons with a purpose, it is impossible to say, but there is little probability that the railroad will abandon its position, even if public opinion would allow it to do so.

We owe to the thoughtful courtesy of the New York *Nation* a portion of the Milan *Perseveranza* of July 14, containing the text of the first report of the jury of award in the competition for the completion of the Cathedral of Milan to the Administrators of the Fabric. The report contains only the account of the proceedings of the jury in regard to the preliminary competition, and of the considerations which governed it in drawing up the programme for the final one, so that the important facts which it gives have long been anticipated by the telegraphic reports; but there are certain details in the official document which have an interest for the profession. After a little of the preluding inevitable in Italian papers, and a still more characteristic Italian touch in its classification of the competing artists from Venice and Genoa as foreigners in the same category with those from France, England and Austria, the report goes on to explain in detail the method adopted for selecting, out of the large number of designs submitted, nearly a hundred and fifty, those whose authors, fifteen in number, should be invited to compete in the second trial. Seven days "of assiduous labor" were devoted to the task. The first three days were spent in examining all the drawings, so that the members of the jury might become tolerably familiar with all of them, and a vote was then taken for a choice of fifty out of the number for special attention. These fifty were again discussed and compared, and the least meritorious discarded one by one until the number was reduced to twenty-six. This process of selection occupied nearly all the week, and it was then decided to proceed at the next meeting to a selection of fifteen candidates by ballot. The jury voted to try first to choose only such candidates as should receive a clear majority of all the votes cast; and in case this should prove impracticable with certain candidates, to select by "relative majority," or, as we should say, by plurality. Fortunately, the members agreed so well in their opinion that every one of the fifteen candidates chosen received an absolute majority; and there can hardly be a question that the selection was the wisest that could have been made.

It seems that, notwithstanding the provisions of the programme, many of the competitors, particularly those from Milan, had signed their works with their names, instead of a motto, but the jury appears to have concluded to disregard this, perhaps because a strict enforcement of the usual rule would have excluded four out of the six Milanese architects who had been chosen for the final competition. Another curious circumstance about the selection, which, indeed, might well have rendered it necessary to know the names of the candidates before proceeding to vote, was that two of the fortunate persons were, so to speak, multiple competitors, having sent in more than one design. Professor Carlo Ferrario, of Milan, indeed, submitted no less than five projects, under different mottoes, while Signor Cesa-Bianchi, also of Milan, sent three also under motto. Both these gentlemen were chosen in the first fifteen, and one cannot help thinking that if a certain equality of merit had existed among the designs by the same author, it might have happened, in selecting by motto only, that two persons might have been chosen to fill eight places, to the decided embarrassment of the jury and the other competitors. This mishap was, however, avoided and, as our readers know, the honors of the competition were divided among six Milanese architects, one from Bologna, three Austrians, two Germans, a Russian, an Englishman and a Frenchman; one of the Germans, Becker of Mainz, finally carrying off the prize. Taken altogether, the competition was a very memorable one, and in nothing more so than the diverse nationality and training of the successful contestants. It might well be supposed that the Milanese architects, who are hardly ever out of sight of their beautiful cathedral, would carry off the lion's share of honors, and it is not surprising that an Englishman like Mr. Brade, or Viennese architects, brought up in the noble school of modern Gothic founded by Ferstel, should have contended sharply with them; but that a St. Petersburg architect, living hundreds of miles away from any building with the smallest pretense of Gothic character, and surrounded by buildings, either as barbarous in style as a Chinese pagoda, or metamorphosed into a queer Renaissance should have been able to compete so brilliantly against all Western Europe in a style so difficult as the German-Italian Gothic, is astonishing, and the success of the Triestine architect, Signor Nordio, is hardly less so.

ARCHITECTURE ON THE EASTERN SHORES OF THE ADRIATIC.



ENTRANCE.—S. GIOVANNI, LUCCA.
AFTER "THE ARCHITECT."

It is certain that there are many and not the least fortunate, perhaps, to whom the word Illyria is neither a political nor a mere geographical expression, but purely a nucleus of romantic and poetical associations. The shipwrecked Viola of Shakespeare's delightful comedy, asks of the captain and sailors, "What country, friends, is this?" and the reply, "This is Illyria, lady," satisfies her, and we accept as readily the allusion to its government by a Duke whose power seems only limited by his genial temper and romantic sentimentality. When her twin brother Sebastian finds his way to the neighborhood of the same court, and makes the proposal to his friend:

> I pray you, let us satisfy our eyes
> With the memorials and the things of fame
> That do renown this city —

we assume confidingly that the Illyrian city of the poet abounded in such objects of interest, but are as indifferent to whether the actual Illyria contained any city at all, as whether the actual Bohemia had or had not the seaboard with which its poetical antitype in "*The Winter's Tale*," is unhesitatingly credited. It does so happen, however, that the veritable Illyria, as modern Dalmatia, contains within its limits important buildings in abundance to supply back-scenes to a theatrical manager in pursuit of a pretence of authentic local color for a representation of "*Twelfth Night.*" We may smile at these artifices of mock archæology which have pretentiously superseded the more commonplace appeals to the realistic, of Mr. Vincent Crummels, and that pump and real water which his dramatic author was required to write up to. Still, as we wander about Venice we think as often of Shylock and Othello as of the Council of Ten; and certain it is that the Shakespearean associations with the locality are not to be despised, as quickening our interest in the recent explorations of Mr. Jackson. These have just issued in three handsome and admirably illustrated volumes from the Oxford Clarendon Press. The full title of the work is, "*Dalmatia, the Quaterno and Istria, with Cettigne in Montenegro and the Island of Grado,*" by T. G. Jackson, Honorary Fellow of Wadham College, Oxford, Architect. The author was accompanied by his wife in three journeys, 1882, 1884 and 1885, and speaks of inconveniences which soon drive back mere idlers into the beaten tracks with the cheerfulness of a true traveller inspired with a love of art. "There are no difficulties," he says, "to deter those who are strong and well and enjoy exposure and exercise, and can put up with rustic fare and quarters, and speak the Italian language." "The modern Dalmatians deserve to inherit the character — for piety, honesty and hospitality — given by an ancient Greek geographer to their predecessors, the Illyrians of old." The work includes architectural notes from all the cities which in ancient and modern times have flourished, and fallen, and revived upon the margin of the eastern shore of the Adriatic. Behind these at an average distance of twenty miles rises the range of high mountains which shut them off from Crualier, Bosnia, Herzogovina; and in front, seaward, are the parallel lines of long islands which are so conspicuous on the maps and explain themselves at once to the physical geographer as the higher crests of lines of submerged ranges. The history of this district has four well marked periods comprising its fortunes. First, under the Western Roman Empire down to A. D. 476; then under the Byzantine, to A. D. 1102. Thirdly, during the conflict of Hungarians and Venetians; and lastly under Venetian rule from about 1420 to the fall of the republic in 1797. Each of these periods has left a well-marked architectural signature on the land, as well destructively as constructively. That styles should become intermixed therefrom, is as natural as that they should be varied; but, nevertheless, there are numerous examples of important structures completed with refinement and purity, as well as subordinate specimens of detail which claim our admiration. At the present time under Austrian rule, the works which are in progress are chiefly of the nature of restoration, and in too many cases not more felicitously than elsewhere.

The historical sections of the work embody the results of much original research, and entitle it to a place among those which a student is always glad to have within reach; but the very detailed information, which constitutes its value in this respect, may be read indeed with interest for the purposes of knowing where it is to be found when wanted, but miscellaneous as it is, can scarcely be retained; nor is it necessary that it should be. It is enough if certain leading characteristics of the different periods, especially as they bear upon the arts, remain in the mind.

The remains of the vast palace which Diocletian built for his retirement at Spalato (A. D. 284–305), supplies examples of the earliest changes by which the practice of ancient Classic art was relaxed, and architecture was set free to accommodate itself to new habits, new caprices and new developments of noble style. The proportions of the members of the Classic orders are negligent of rule and precedent, and some of them are even omitted entirely; forms of ornament are admitted which are entirely novel; and arches spring from the capitals of columns, without intervention of any member of an entablature. This last innovation so far as it extends, constitutes a distinct repudiation on the part of the architecture of the arch, of the special trammels of the trabeated architecture with which it had been so long encumbered. So far it has been correctly pronounced to be the beginning of all the later forms of consistent arched architecture, Romanesque or Gothic, or any other. But it would be rash to conclude that the architect of Spalato was the originator of it or understood its real importance. He seems to have resorted to it as a convenient mode of adjusting the required height of an associated colonnade; and here, as in his other licentious vagaries, was not in awe of academic criticism. In his temple of Jupiter, which is now the Duomo, he betrays his ignorance of the value of his innovation, for he adheres conspicuously to the Roman solecism of important columns supporting mere projecting returns of an elaborate entablature, without any relation to the bearing of the dome which rises from the wall behind them. Mr. Jackson notices among other novelties an example of decoration by that miniature arcading which was to play so large a part in Romanesque and Gothic work, and which he observes is but a few steps removed from the arcading in the Duomo at Zara built a thousand years later. But here again we have only a crude suggestion which awaits true recognition. Various traces of barbarism and unskilfulness are found throughout, along with much good work — carving which suggests the hand of a Greek workman, with capitals misfitted at second-hand to their columns, and stumpy shafts surmounting others of fairly elegant proportions.

We have here, in fact, an indication how Classic architecture broke up like Classic language, by combined negligence, ignorance and independence: both passed through an intermediate stage when neither vulgarisms nor new forms of expression were rejected, so long as they produced the required impression and conveyed the intended meaning. The friction of popular usage does much in either case to help the transformation; but the intervention of true genius is required to develop bad Latin into elegant Italian, and debased Classicism into perfected Lombardic, Romanesque or Gothic style.

Within two hundred years a pure Byzantine style was developed, of which a glorious example exists, as in the basilica of Parenzo, on the coast of Istria. Mr. Jackson writes of it with enthusiasm. How well this is justified will be appreciated by those who can compare his descriptions and illustrations with their memories of the basilicas of Ravenna, on the opposite coast of Italy.

"The church of Euphrasius is a specimen of the Byzantine style at its best. Classic tradition survives in the basilican plan, the long-drawn ranks of serried marble columns, and in the horizontal direction of the leading lines. But the capitals, with their crisply-raffled foliage, emphasized by dark holes pierced with a drill, which recall the fragility and brilliancy of the shell of the sea echinus, belong to a new school of sculpture; and the massive basket capitals which are found among them, as well as the second capital or impost-block, which surmounts them all, were novelties in architecture at the time of their erection. These buildings belong to the best school of

Byzantine art, and were erected at the same period as those at Ravenna and Constantinople, which they resemble in every detail: and in the church of Parenzo one might imagine one's self in the ancient capital of the exarchs."

The transition to Lombard Romanesque is observable in many buildings which date very near that year 1000 A. D., which is so prevalently an architectural epoch throughout Europe. The Venetian or Hungarian period is dated 1102–1409; but Mr. Jackson is able to identify Byzantine traditions influencing architecture even down to the development of Italian Gothic in the fourteenth century. Most conspicuous, important and beautiful are the campaniles of the Venetian period. The illustrations which are given of them justify us in heightening the terms of admiration of the author, to the extent of declaring several of them very far superior to the most admired of the Italian peninsula. That of the Duomo of the little island of Arbe, dating about 1200 A. D., is still in excellent condition; it is described as a magnificent tower, which challenges comparison with any of its kind elsewhere. "The outline is simple and the proportions satisfactory; the scale is grand enough for dignity, and the architectural features are judiciously disposed, gradually increasing in importance and richness towards the top; the tower is twenty feet square at the base, and the height, exclusive of spire and parapet, is about ninety feet."

The grand campanile of the Duomo of Spalato is some one hundred and sixty feet high. It is of homogeneous style, though the construction of it was interrupted and carried on at intervals from about 1270 to 1416. Mr. Jackson gives an excellently-executed elevation and sections of the several floors or stories. No tower in Italy will bear comparison with it for true artistic feeling for composition and mastery of detail. It rises from the old steps and platform in front of the Temple of Jupiter within the Palace of Diocletian, and while it bears the general stamp of fully-developed Romanesque work, it bears also unmistakable traces of influence from the Roman work of the third century, by which it is surrounded. That this could be done with the effect of enriching, not vitiating, the predominant style is a wonderful testimony to the genius of the architect. It is as instructive as delightful to observe how he has paired the first and second stories, and then the third and fourth, yet with a variation within each pair, and a variation so admirably invented that it constitutes a principle of gradation which links them all from the lowest to the summit.

The far simpler campanile of S. Maria, at Zara, is a fine example of the type which is equally prominent and prevalent at Rome, at Verona and at Cologne, and many of their adjacent towns and cities. "It has the same unbuttressed outline, the same group of windows, increasing in number as the tower rises, stage above stage, and set in shallow panels between framing flat pilasters, and the same window-shafts, set back to the middle of the thickness of the wall, and carrying imposts that project fore and aft, to take the thickness of the wall above."

Abundant architectural fragments and foundations bear witness to the importance of this site in Roman times; after the intermediate Byzantine period it was devastated by Huns and Avars, but revived to become, as Zara, the most important city of the province: for eight centuries it was only eighty years in all out of the possession of the Venetians, and the characteristics of Venetian art are, therefore, very abundant; but while it possesses a tolerably complete series of architectural examples of every period from the eighth century downwards, the city is particularly rich in buildings of the earlier styles. These, it is true, have, for the most part, to be found disguised as magazines, hay-lofts, and cellars. One alone of them remains conspicuous, San Donato; and, in spite of being rude almost to barbarism, it has a certain dignity from its very ponderous construction: it probably dates from about 806 A. D. It is a round church, of the same type as that of S. Vitale, at Ravenna, the prototype of the cathedral of Aix-la-Chapelle, but has interesting differences. Constantine Porphyrogenitus, who knew it as dedicated to the Holy Trinity, describes it as consisting of one church over another, and traces of the original arrangement of the upper story bear him out.

Very contrasted is the Duomo; the façade of this is the finest in Dalmatia, and is of a style and execution which, if we were suddenly set down before it, might suggest the question, are we in Pisa, or Pavia, or still more probably, in Lucca? A plain lower story with arge central and two lateral recessed round-arched portals, gives great effect to the tiers of the arcading above, and the rich detail of the graduated arcading of the half gables of the aisles and the central gable, and the concentric arcuation of the two rose windows.

It may be confidently said that many will read the account of the Duomo of Traü and compare it with the illustrations, and be unable to suppress a feeling of enviousness of the good fortune of those who have been able to see the building itself. The author's description is as free from exciting mistrust by an appearance of willingness to seize an occasion, at any cost of conscientiousness, for a parade of fine writing, as from the offensiveness of an authoritative tone, commanding us to admire at our peril what we should never think of admiring independently. Here, as throughout, exaggeration and paradox are alike eschewed, and the work put before us is trusted to commend itself with the plain introduction of calm intelligence and unsophisticated taste.

This, also, is a triapsal Romanesque church, and is built throughout in one consistent style, and according to one design. It has, also, the advantage, so rare in Italy, of being completed outside as well as inside. It has the distinction of a magnificent Galilee porch or narthex at the west end the full width of the nave and aisles. "This porch forms a grand vestibule, adding much to the dignity of the church; and the tempered light within enhances the solemn splendor of the sumptuous western portal of the nave, the glory not of Traü only, but of the whole province, a work which in simplicity of conception, combined with richness of detail and marvellous finish of execution, has never been surpassed in Romanesque or Gothic art." It is dated by an inscription A. D. 1240.

Within the limits of an article like the present it is impossible to communicate more than an inadequate impression of the wealth of information and interest contained in these three volumes. The materials are, for the most part, arranged in the order of a tour, and the monuments of each city are therefore treated together, whatever may be the differences of their dates and styles. But the indexes and tabulations give every assistance to the students who will be induced to re-read the work and follow forth the progress of the art in each particular style in its order.

The examples of fine Italian-Gothic, in the later Venetian period, are of the greatest refinement and variety of beautiful treatment. A plate is given of an admirable Franciscan cloister on the island of Curzola. The Duomo of Sebenico will also be turned to with interest.

Ragusa — "perhaps the most agreeable place in Dalmatia for a prolonged stay" — has suffered much serious loss of architecture by a destructive earthquake. Still it retains specimens, and very fine specimens, of almost every chapter of Dalmatian architectural history in Duomo, churches, the Rectorial Palace. A round-arched Franciscan cloister with peculiarly light columns, strange to say, was spared by the convulsion, and the author speaks of it as "one of the most singular pieces of architecture I have ever seen." It is at Ragusa that a glorious series is closed, 1699–1715, with a Chiesa dei Gesuiti, to which is attached the fatal word — "barocco."

And here must conclude an attempt to at least direct attention to the interesting contents and distinguished merits of a thoroughly satisfactory work. W. Watkiss Lloyd.

PARIS GOSSIP.

DECORATIVE WORK AT THE SALON.



In my last letter I expressed the intention of discoursing to you of the work for the Exhibition of 1889, now in course of execution on the Champ de Mars. I also would like to speak of the new railroad station of St. Lazare; but talk on these two subjects can be easily taken up at any time, and I prefer to-day to say a few words concerning the *Salon* of 1887, which has just closed its doors.

Two questions are asked each year at the time of the *Salon*, "Is it good?" "Is it bad?" Reply is difficult enough. The *Salon* is almost always the same. It is good and it is bad at the same time. A general criticism to apply to it is that the quantity of inferior paintings admitted is always too great. Good paintings are lost in the midst of this confusion, and often when one has at length discovered them they suffer by their surroundings. Moreover, the fatigue occasioned by a too long search makes the visit to the *Salon* a weariness to the flesh. The eye quivers, colors mix themselves up, and the judgment feels the effect of it.

The first impression of this year's *Salon* was not good, because of this agglomeration of works more than commonplace. The list included 2,521 numbers. The entire exhibition, including sculpture, architecture, drawings and engravings, offered to the visitor 5,318 works of art. This is a great deal; in fact, it is too much. I will run hastily through the paintings before speaking of the architecture. That part of the exhibition is usually neglected by the public, who enter that department only to rest themselves and take a breath of fresh air in the galleries which overlook the garden — the galleries to which are

relegated the frames containing the offerings of our unfortunate architects. Perhaps this is a little their own fault. We will consider that presently.

One kind of painting whose progress is noticeable every year is landscape work. Almost all the landscapes are charming. The landscapists now put into their canvasses a truthfulness which is truly seductive. I do not say this of Ernest Duez, who exhibits an enormous canvass representing two cows upon a rocky coast, and styled "Evening." If I mention this painting it is because it is much spoken of, because in my opinion it has been praised too much, and because the Parisian journals have tried to force its success. Now, the painting is not good: in the first place it is too large, occupying a great portion of one side of the *Salon carré.* The two cows are stiff, the rocky shore is a disagreeable green in tone, too raw, and finally style is missing. The sea in the right-hand corner of the picture seems to bathe the grass on the shore. It is bad and quite unworthy of Ernest Duez, who has done very pretty things. But what good landscapes are those of MM. Alexandre Rapin, Pierre Damoye, Jean Georget, Edmond Petitjean, this last, of whom people do not talk much, has veritable talent, and his "*Village Comtois*" is charming. I will mention also MM. Louis Japy, Julien Dupré, Emile Breton, Léon Lhermitte, and the sea views of Georges Haquette and Emile Renouf.

The medal of honor this year was carried off by M. Fernand Cornon. His great painting, "The Victors of Salamis," is a good museum picture. The figures are well grouped, and the color is agreeable and clear. I take exception, perhaps, particularly to the female figures, which are a little too modern in type, I will even say too Parisian. Amongst the notable bits I will mention that of M. André Brouillet's, "A Lesson in Clinics," at the Hospital of the Salpetrière, in which the figures, life-size, are portraits of well-known doctors, artists and literary men, which creates a public interest in the picture. Another hospital scene is by M. Henri Gervex. A fine portrait of Mounet Sully, of the Comédie-Française in the rôle of Hamlet, by M. Theobold Chartian, a beautiful Andromeda; by Carolus Duran — a nude figure; two very remarkable pictures by Jean Jacques Henner; an Herodias, and especially a magnificent portrait of a creole seen in profile are worth mentioning. The portrait of General Boulanger, our ex-minister of war, by M. Debat-Ponsan, attracted a great deal of attention. The popular General is represented on horseback. The man is very well handled, but the horse is less successful; its forelegs have a dubious action and are wanting in decision.

I could mention also Mr. William Bouguereau, whose drawing is so sharp and clear, but whose color is unfortunately dingy. I could say the same thing of Alexandre Cabanel, and after having mentioned several good portraits by MM. Jules Lefebvre, Adolphe Yvon, Léon Bonnat, Joseph Wencker, etc., I will speak of two decorative compositions that have much interest for us architects. These are those of MM. Puvis de Chavannes and Francois Flameng for the decoration of the new Sorbonne, of which M. Paul Nenot is the architect. The work of M. Puvis de Chavannes was set before us as a sketch. Of his cartoon the Salon catalogue tells us: "This composition which is to decorate the hemicycle or great amphitheatre of the Sorbonne, a monument consecrated to Literature, Science, Philosophy and History, is divided into three parts. In the central one, upon a block of marble, is seated the ancient Sorbonne, having at her sides two genii bearing crowns and palms in homage of the living and the glorious dead. Eloquence standing erect celebrates the struggles and conquests of the human intellect; upon the right and left are groups of listening figures which symbolize the different forms of poetry. From the rock upon which they rest streams a life-giving spring. Youth drinks at it with eagerness, and Old Age absorbs from it new force. The left-hand compartment is reserved to Philosophy and History. The first is symbolized by a group of figures representing the struggles of Spiritualism and Materialism against Death, the one affirms by a gesture a radiant aspiration toward the ideal, while the other shows a flower as the expression of terrestrial joys, and the successive transformations to which matter is limited. The second group shows History interrogating the Past, here represented by remains of antiquity which have just been exhumed. The right-hand compartment is consecrated to Science: the first group, corresponding to that of the Muses, is composed of four figures, Botany, the Sea, Mineralogy and Geology. Some young people are admiring these riches, while others grouped before the statue of Science swear with common aspiration to devote themselves to it. Three youths absorbed in study complete the composition."

One can judge from these words how extremely allegorical the composition is. I think it is too much so. Lately, apropos of the exhibition of the designs for the decoration of the mairie of the town of Pantin I espoused the allegorical as against the encroachment of too modern subjects, but if the modern subject is open to criticism, allegory is equally so when it is abused. There is, it seems to me, a middle ground, which all should strive to reach. Against allegory it can be said that it is not easy always to comprehend it, and I will seek for no other proof than the need which M. Puvis de Chavannes himself has felt of explaining his complicated subject. In fact, when examining this composition, in order to appreciate it, one must understand in detail the ideas which the artist wished to express, and know what these women, whether clothed or naked, and these men arranged in groups, really represent.

This is the criticism which I will allow myself to make upon this work: it is arranged and disposed in a stiff and academic fashion. The figures seem to have quitted the woods and vast meadows which close the background of the scene, in order to come to the front of the stage and form there a tableau vivant. It is a fault, in my opinion, to have given so great an importance to this meadow, which extends a great way, empty and bare. This makes still more disagreeable the impression that these figures have grouped themselves before the curtain. But we shall be able to judge this composition better when it is finished and color has given it a little animation. Nevertheless, I can't help feeling that it is inferior to that which M. Puvis de Chavannes sent in last year. I leave out of sight, of course, the question of color and finish. The work which we admired in the Salon of '86 was finished to be sure, but still, from the point of view of composition, it was preferable.

The picture called "Christian Inspiration," which shows a fifteenth-century artist decorating the walls of a convent with religious subjects was quite remarkable, and I should not be astonished if M. Francois Flameng should have borne it in mind when he sought the subject of the decorative composition which he showed this year. It is in truth from the same order of ideas that he has selected the happy motive of his composition. It is not allegorical, and no more is it modern. This is easily seen. It is the safe middle ground of which I spoke just now. It is a picture which relates to the history of the building under decoration, and I find this far more interesting than an allegorical scene which has no connection with the subject, and which is connected only by abstract ideas, which are not within the grasp of everybody.

M. Flameng was charged with the decoration of the stairway of the Sorbonne. His composition, representing the history of letters, is divided into three parts, of which the middle is the most important. In the left-hand portion St. Louis delivers to Robert de Sorbon the foundation charter of the Sorbonne. This portion is very beautiful and well arranged. In the central panel we see Pierre Abelard, philosopher of the beginning of the twelfth century, teaching his doctrine upon the Montaine Geneviève. At first one is shocked by the red and too flat robe which Abelard wears, which forms a blot in the painting, but, nevertheless, one is attracted by the composition as a whole, by the well-grouped figures, by the tones in harmony with one another, by the atmosphere which reigns throughout, and by a truly ravishing background, which represents the ancient Cité of Paris in the twelfth century, with Notre Dame in course of construction. Some critics have maliciously asked M. Flameng if Notre Dame was truly in such state at that period. Perhaps this was only to obtain information. The right-hand portion represents Prior Jean Heynlin setting up in the cellar of the Sorbonne the first printing-press which had been established in France. On reflection, one is curious to know how these cellars happen to be so well lighted by lofty glazed windows, which allow the daylight to penetrate within. Still, the painting is attractive, and I only find fault with one figure, seen from behind, whose legs promised to have a too tortuous action. In fine, the work of M. Flameng is very beautiful, original and interesting.

I would like to speak of another decoration by M. Paul Besnard, intended for the Salle des Mariages of the marie of the First Arrondissement. This composition, which is styled "The Evening of Life," is charming, and I am the more willing to bear this testimony in that I have been severe upon M. Besnard, whom I find unequal in his work and aiming too often at mere originality. This "Evening of Life" shows two old married people seated before their door leaning one upon the other, and looking up into the clear and star-lit sky in search of all the happy memories of their life. There is in it poetry and exquisite sentiment. The tone is gray and pleasing. The architecture only is awkward, for the stone looks very like pasteboard; but the principal motive is fine, and the work shows talent.

Now let us attack the architecture. I said just now that if the architects were abandoned by the public it was somewhat their own fault. In short, why exhibit so many academic designs, so many school *projets?* These are not very interesting to common mortals. Of course, technical drawings must be sent in. Details of trade, which are of interest only to a certain portion of the visitors could be gathered in one special chamber, where people would know how to find them; but the rest of the exhibits, could they not say more to the eyes of the ordinary visitor? Architects manage the brush with sufficient ability, and have taste enough to show within their frames more interesting motives than dry and cold geometrical façades. There were, at the *Salon,* many pretty drawings, but they were quite lost in the midst of the big frames of the competition drawings and too classic studies. Now, the greater part of these works have, as a rule, been seen already by that portion of the public which is interested in them, and keeps the run of their special exhibitions; and as the rest of the public does n't care anything about them, it follows that architecture is neglected at the *Salon.* Decorations, ornaments, interiors, compositions would, I believe, attract a greater attention. To show the public that the architect can respond to its every need with intelligence and taste would certainly attract it.

One of the interesting exhibits is that of M. Louis Lheureux, who shows a scheme for the enlargement of the Law School, which evinces much taste and knowledge of art, and a great ability to extricate himself from difficulties.

M. Adrian Chancel exhibits studies for the interior decorations of

a casino. M. Charles Wable shows an Algerian palace, proposed for the Exhibition of 1889 — M. Wable has made a specialty of Oriental art, which he presents to us under every guise at all the exhibitions. It is always well studied and does not lack charm. M. Wable has obtained a first medal.

With M. Pierre Esquié we return to Rome with its restorations, its temples and gardens. It is all very fine, but it is always the same thing. A second medal.

M. Alphonse Gontier exhibits an interesting restoration of the Château du Rocher, at Mezangers, good in design and agreeable in color. Third medal.

M. Pierre Benouville shows restorations of the Château du Chalucet and of the Abbey of Flaran, studies very exact and correct in drawing, but cold in rendering. I would, for the sake of the *Salon*, that they had in them more that was picturesque.

M. Cassien Bernard shows a design for a monument to Victor Hugo. This monument, designed for erection on the site of the Palace of the Tuileries, is connected with the Arc de Triomphe of the Carrousel by grand colonnades. The whole is well managed, but in the details we find only the decorative motives of antiquity. Thus originality and the mark of personal prowess are wanting.

M. Albert Devienne has sent his *projet* submitted in the competition for a diploma, a very complete study of a country house, which has earned him a second medal. It is very good, very interesting, but I maintain that for the *Salon* a little more color and picturesque handling to attract the ordinary public and interest them in our work would have been better.

M. Robert de Massy, on the other hand, did what he could to accomplish this end. His little compositions are very attractive and conceived in a vein of originality. His *cabaret*, "The Black Leopard," is full of taste and fantasy. Honorable mention.

As for M. Philippe Leidenfrost, he offers us the house of Victor Hugo. If, as the artist seems to wish to make us believe by the legends with which he decorates his *projet*, the great poet himself dictated the programme for this habitation, it only proves that his ideal of architecture had nothing in common with simplicity. It is complicated, surcharged with ornament, and a very torment of styles. The jury, nevertheless, accorded to it an honorable mention.

With M. Jean Gayet we come to the Temple of Luxor, a fine study of the great temple exhumed by M. Maspéro. Honorable mention.

Then a crowd of little exhibition drawings and a crowd of frames sent in by young men whose only aim was to obtain a card of admission. These are more or less interesting. In fine, the great attraction of the *Salon* of 1887 were the two decorations of Puvis de Chavannes and François Flameng. These works can be criticised, of course, but they nevertheless mark the date of a grand artistic manifestation.

M. Brincourt.

The Illustrations

[*Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.*]

GATE-LODGE TO THE ESTATE OF THE LATE MISS CATHERINE WOLFE, NEWPORT, R. I. MESSRS. PEABODY & STEARNS, ARCHITECTS, BOSTON, MASS.

[Helio-chrome, issued only with the Imperial Edition.]

THE ROTCH TRAVELLING-SCHOLARSHIP DRAWINGS. — PLATES LV., LVI., LVII.

[Issued only with the Imperial Edition.]

THE COLLEGIATE CHURCH, GUADALUPE, MEXICO.

In the *American Architect* for February 7, 1885, in No. IV of "Strolls About Mexico," appeared an excellent account of a visit to Guadalupe, the most famous suburb of the city of Mexico. It is unnecessary to repeat here the legend, briefly related in that paper, which made that town so noted. Its handsome churches now support its fame, and yearly attract hundreds of visitors who are incredulous as to the actual appearance of the "Blessed Virgin" in 1532 to an Indian, Juan Diego by name, on that spot, as well as thousands who have the most implicit faith in the story. Of these churches, the one purporting to be built for the use of the Indians by the Virgin's express commands is the largest and most imposing. It is a collegiate church, not a cathedral, as usually named. The accompanying illustration will convey a far better idea of its external appearance than any written description could possibly give. It was completed in 1709, and is the fourth building occupying the site selected by the Virgin for a church, though in part composed of former structures. It is about 180 feet long by 120 feet wide. The illustration presents the west front and chapter-house. The height of the dome is 125 feet, and the four corner towers are 110 feet high. The interior is widely known throughout Mexico as containing silver ornaments to the value of $2,000,000. The railings around the high altar and leading thence to the choir at the opposite end of the church are of silver. Two rows of Corinthian columns divide the aisles from the nave and support the roof. The high altar is of various-colored marbles, and harmonizes well with the body of the church, which is of white, ornamented with gold. The altar was begun about the beginning of the present century, but not completed until 1836. It contains a tabernacle, in which is preserved the mantel having the portrait of herself, painted by the Virgin when she appeared to Diego.

The Chapel of the Little Hill (*Capilla del Cerrito*) appears on an elevation in the rear of the Collegiate Church. It presents nothing of interest in the way of architecture; it was built about the same time as the Collegiate Church.

DESIGN FOR THE METHODIST EPISCOPAL UNION CHURCH, PHILADELPHIA, PA. MR. J. C. WORTHINGTON, ARCHITECT, PHILADELPHIA, PA.

The design for the M. E. Union Church, of Philadelphia, was prepared at the request of the building-committee of that church early in the spring of this year. The building, as drawn, is entirely of stone, including the roof of tower; the main roof being dark purple-red slate. The structure proper is 54′ x 88′, exclusive of the projections of tower and transepts. The tower finial is one hundred and twelve feet above the pavement, and the tower itself is utilized in the ventilating scheme of the building. The problem called for a substantial, permanent stone structure, complete in its appointments, characteristic in its exterior effects, arranged to accommodate eight hundred persons in the church and about seven hundred in the sunday-school, and all this at a low figure. The interior decoration it is intended shall be left to the future. The walls being simply finished in plaster sand-coat.

ACCEPTED DESIGN FOR THE BENNINGTON BATTLE MONUMENT, BENNINGTON, VT. MR. J. PH. RINN, ARCHITECT, BOSTON, MASS.

The corner-stone of this much-discussed structure was laid August 16.

DESIGN FOR A CHURCH. MR. ROBERT BROWN, JR., ARCHITECT, BOSTON, MASS.

OLD HOUSE AT PERIGUEUX, FRANCE. DRAWN BY MR. OLIVER C. SMITH, CHICAGO, ILL.

TOWER OF SAN PABLO, SARAGOSSA, SPAIN.

BUILDING MATERIALS.[1] — I.



The term "Building Materials" embraces so wide and comprehensive a subject, that it may be well to make some explanatory remarks as to the nature of the information that is intended to be conveyed regarding the several matters to which I propose to direct your attention. As regards one of the most important of these, stone, it will be my endeavor to point out, as far as possible, the differences which exist in the composition of the principal descriptions used for constructive purposes; and the properties which stone should possess to enable it to resist the action of those influences which tend to bring about its disintegration and decay. Your attention will be directed to the nature of the proposals that have been made from time to time for the preservation of stone, and to the results that have been attained as regards the manufacture of what may be regarded as coming under the designation of artificial stone.

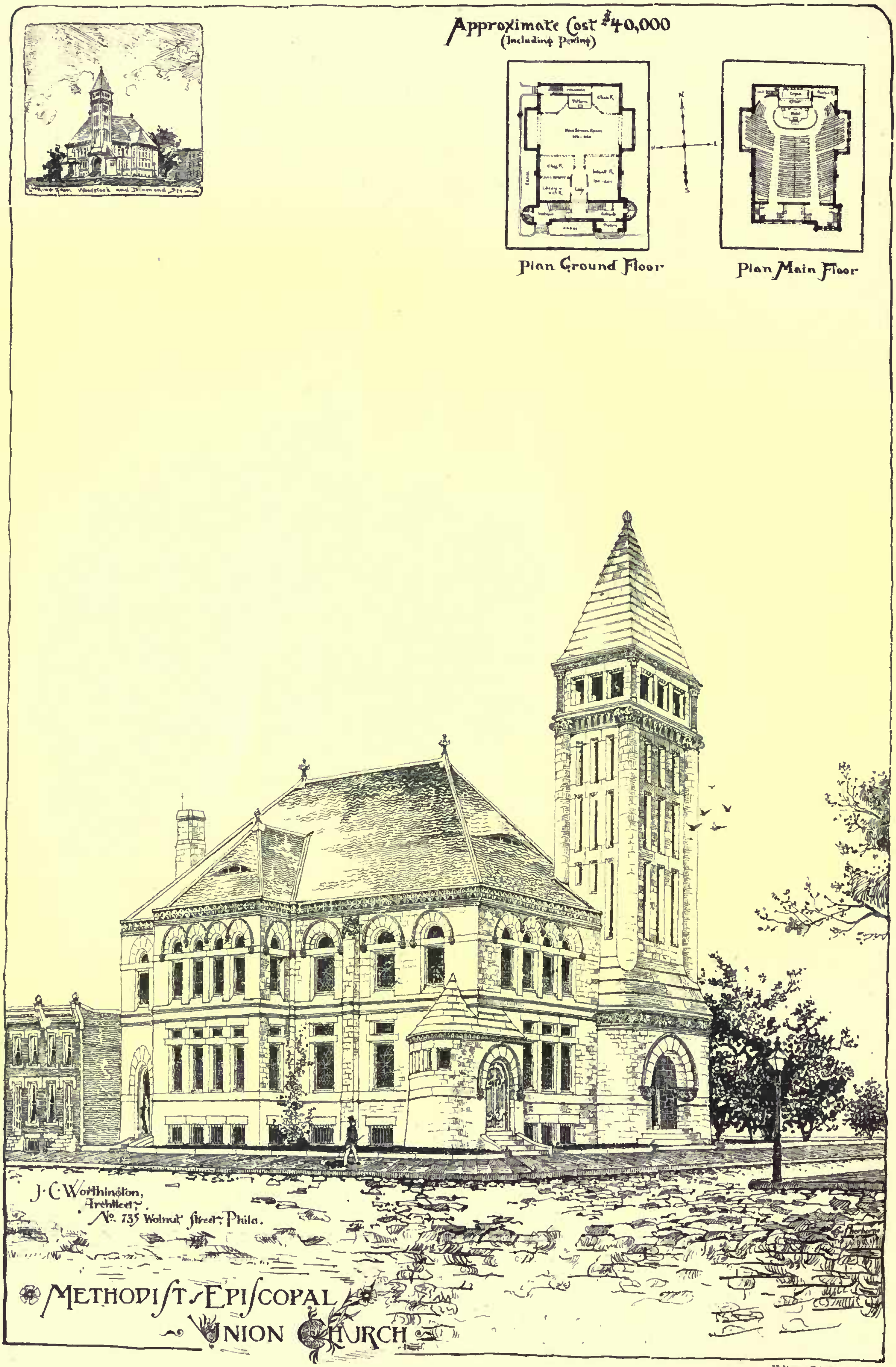
With respect to limes and cements, I hope to be able to afford some information as regards their respective constituents, the processes adopted in their preparation and manufacture, and the advance that has been made in the improvement of such processes during the last thirty years, and also to introduce to your notice some rather novel applications of the most important of all the different varieties of cements, generally known under the name of "Portland."

As regards wood, I shall confine myself to the question of its preservation from decay, and to a description of the various processes that have been adopted to increase its durability, and enable it to resist the attacks of the teredo and other boring worms.

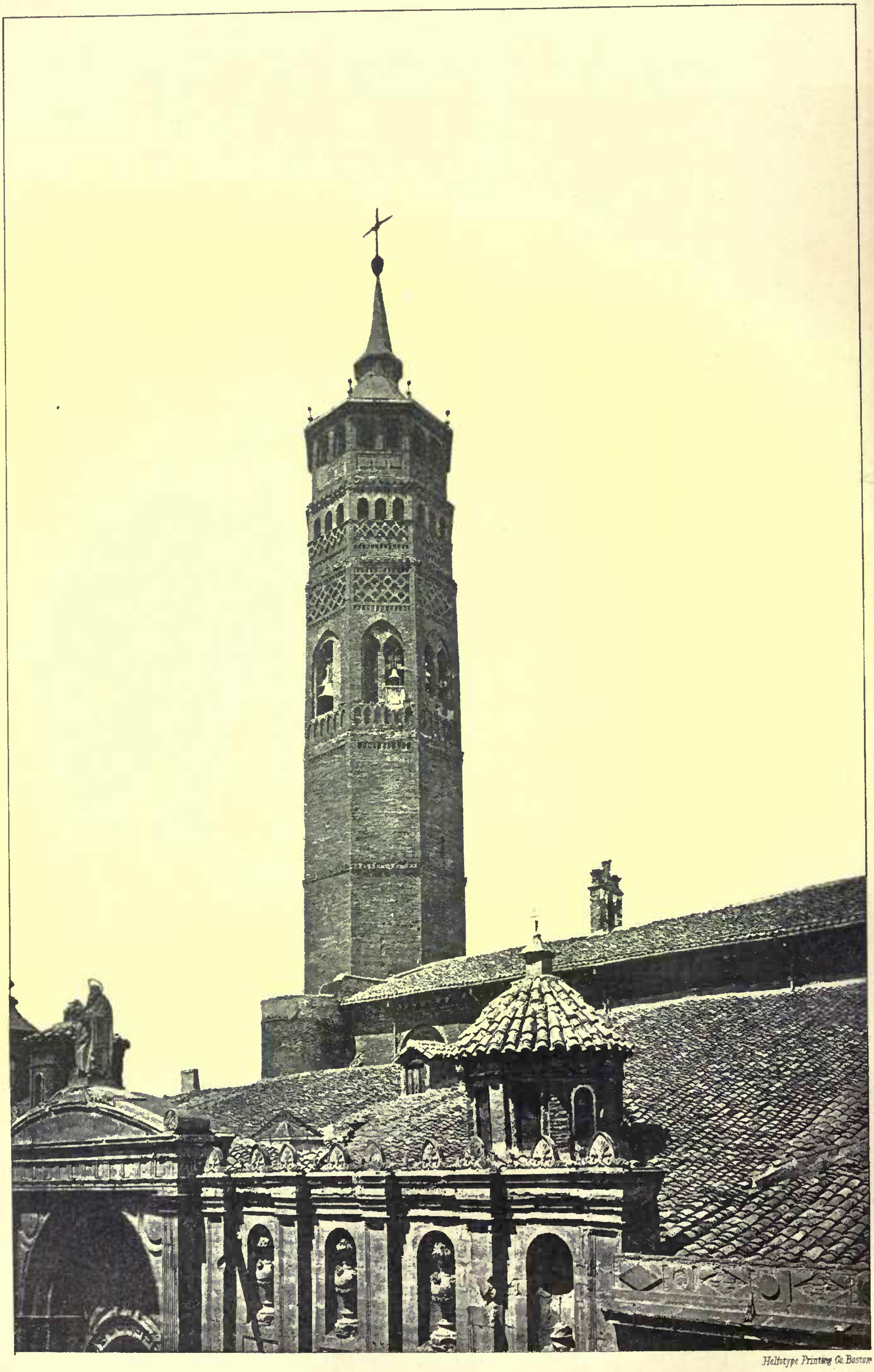
Lastly, in connection with the subject of paints, I shall have a few remarks to make as to the nature and composition of some few of those that constitute the basis of that vast and ever-increasing number used for the preservation of wood and iron, which are continually being forced upon the attention of the public.

It is well known that although the differences which exist in the character and behavior of various substances may, for the most part, be generally attributed to diversities in their composition, as

[1] A lecture by W. Y. Dent, F.C.S., F.I.C., read before the Society of Arts, and published in the *Journal* of the Society.

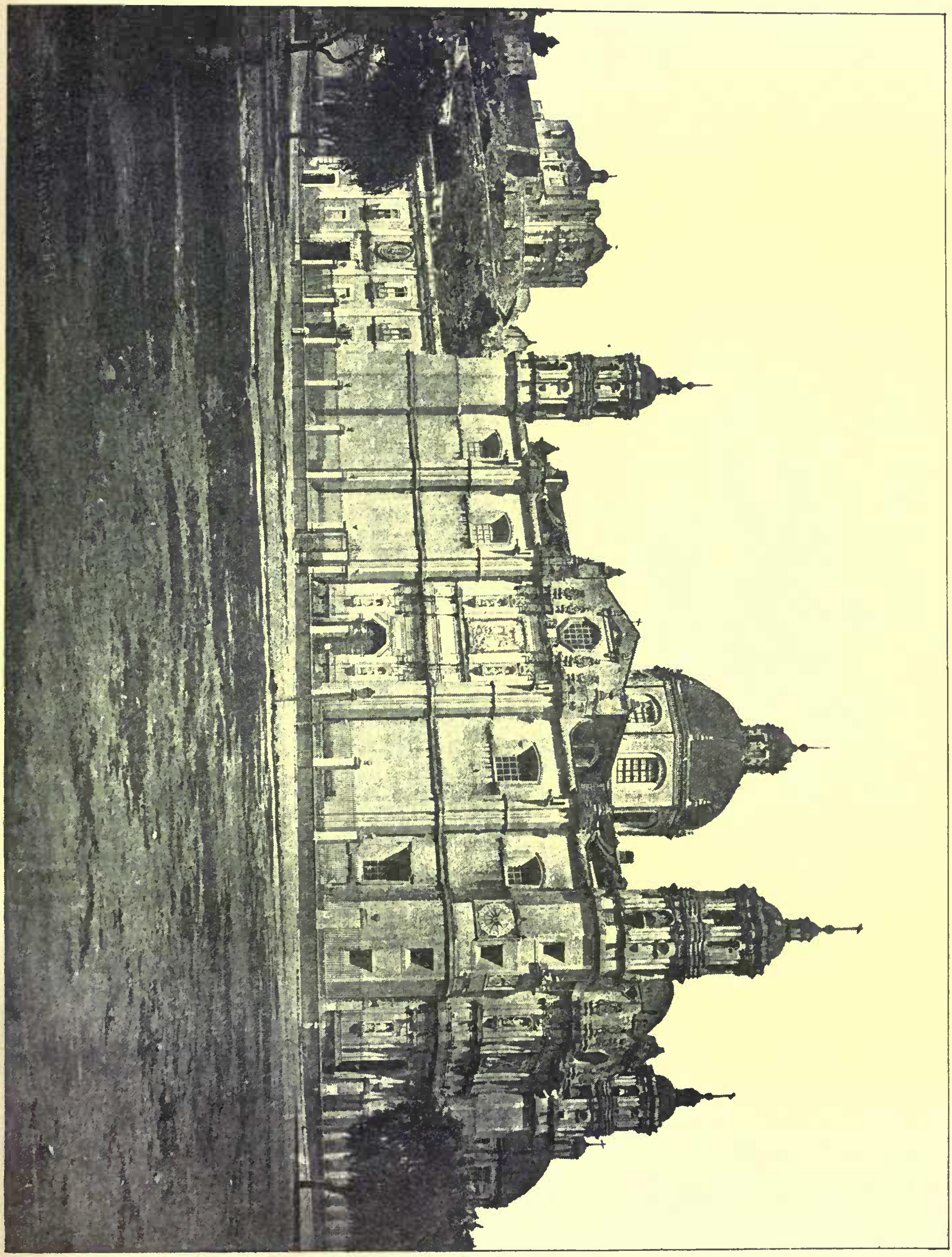


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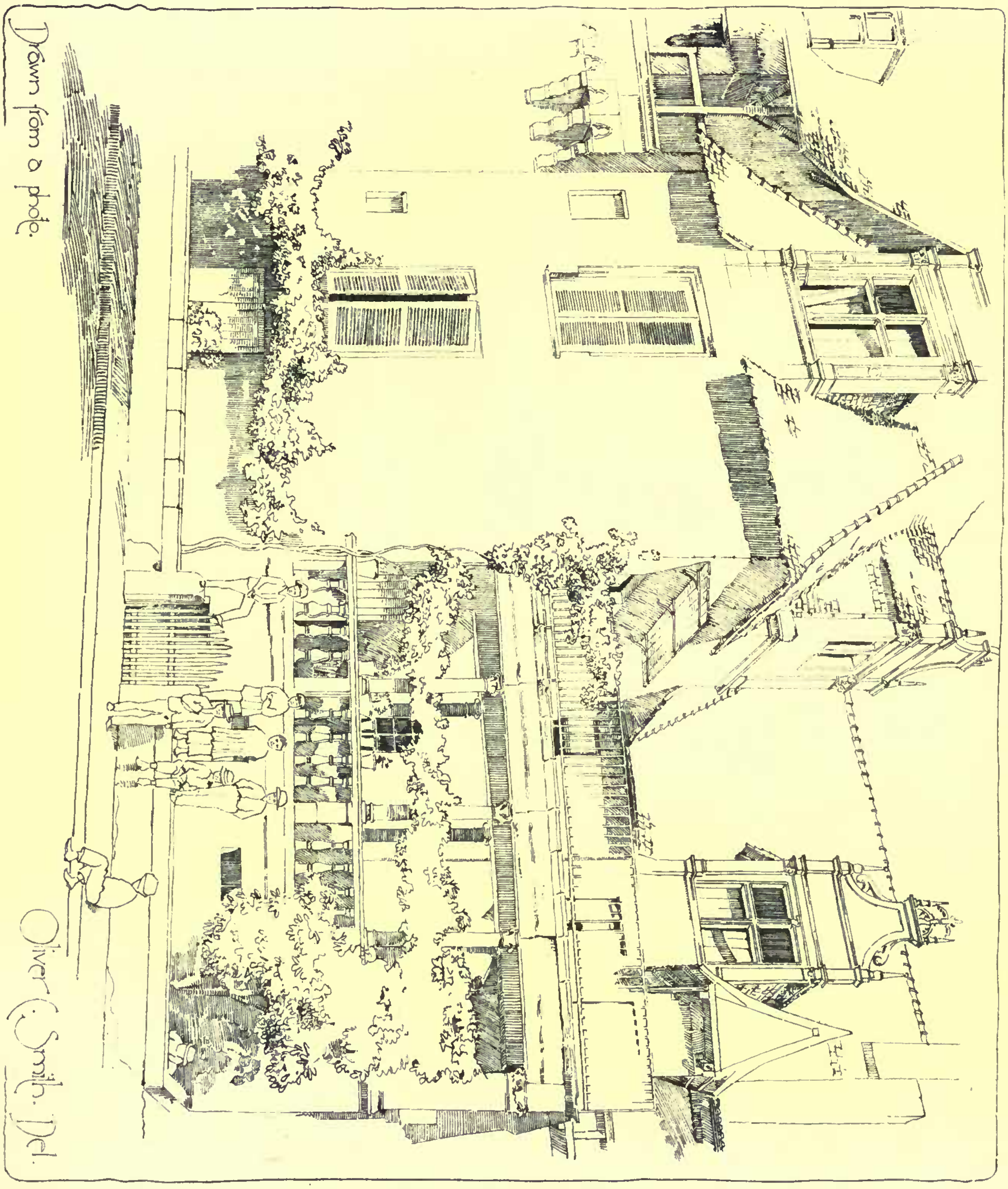
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Tower of San Pablo, Saragossa, Spain.

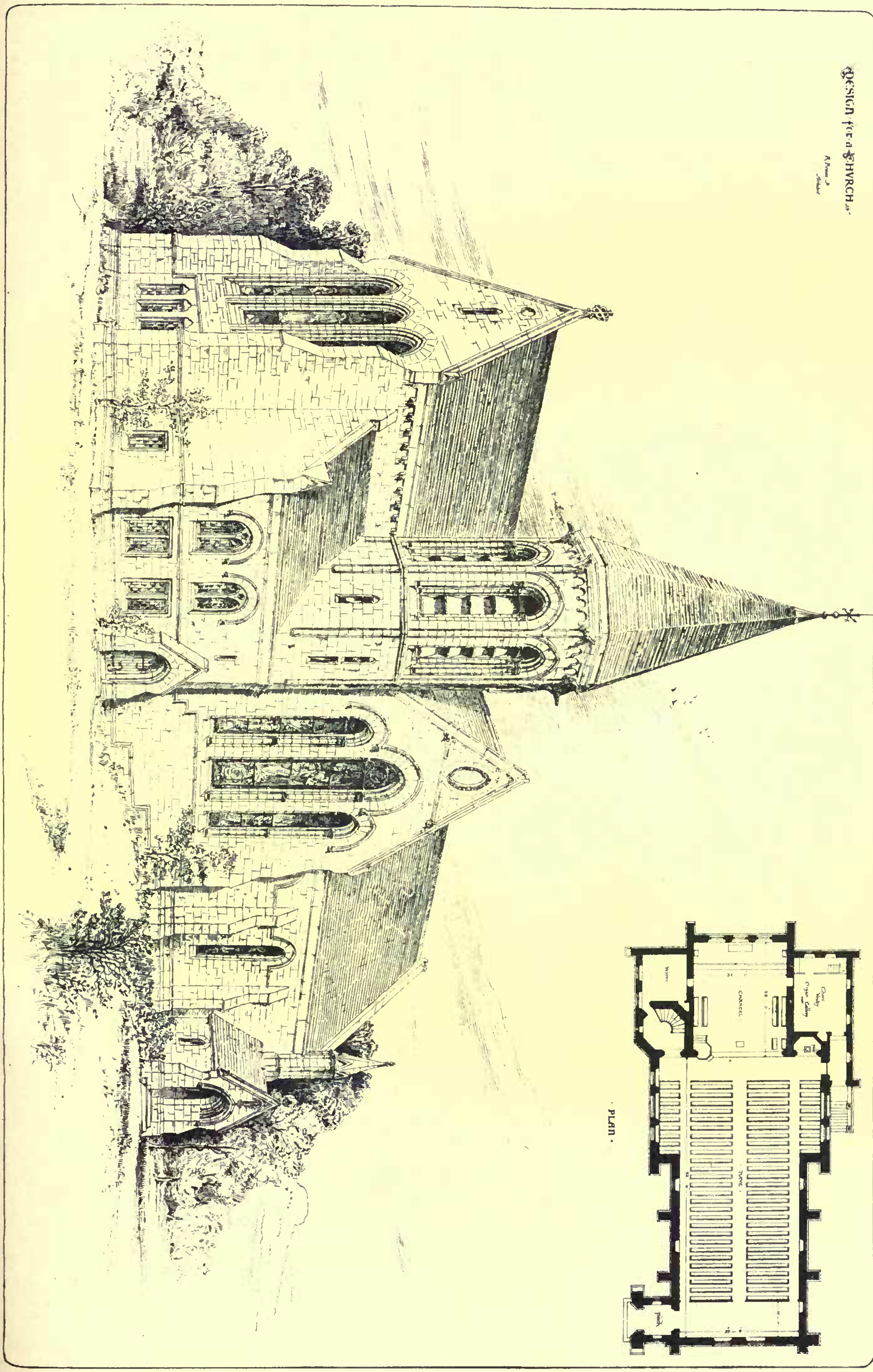


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AMERICAN ARCHITECT AND BUILDING NEWS, AUG 20 1887 No. 608



House at Perigueux. France.


DESIGN for a CHURCH
PLAN
CHANCEL
NAVE

determined by chemical analysis, yet in many cases these differences are due simply to changes in their molecular structure. It is necessary to remind you of this fact in connection with such a material as stone, because the value and quality of stone depends quite as much, or even more, upon its physical structure than upon its chemical composition. I may recall to your recollection a few familiar examples of important changes being effected in the behavior and character of a substance, without such changes being accompanied by any alteration in the proportion of its chemical constituents. By subjecting starch to a temperature of 400° Fahrenheit, it is converted into dextrin, or British gum (as it is sometimes called), a substance differing in its physical properties, but having precisely the same elementary constituents as the original starch, the proportions of carbon, hydrogen, and oxygen remaining unaltered; the change which takes place in the starch is caused by an alteration, produced by exposure to this temperature, in the molecular arrangement of its component particles. We have another example of a similar kind in phosphorus, which, under ordinary conditions, takes fire on exposure to air, and is readily soluble in carbon disulphide, but when exposed to an atmosphere of carbonic acid or other gas that exerts no chemical action upon it, to a temperature of 460° Fahrenheit, it assumes what is called an allotropic modification, in which form, under the name of amorphous or red phosphorus, or Schrötter's phosphorus, it is no longer acted upon by the liquid in which it previously dissolved, nor does it take fire when exposed to the air, and is thus converted into a material suitable for the manufacture of matches.

Zinc is a metal which exhibits very marked changes when exposed to the influence of variations of temperature. As ordinary spelter it is brittle; by exposure to a temperature of from 250° to 300° Fahrenheit, it becomes malleable, and advantage is taken of this change to obtain the metal in a suitable condition for rolling into sheets; whilst, if the temperature be raised to 410° Fahrenheit, it becomes so brittle as to be capable of being powdered. The differences which exist in the quality of iron and steel are also, as is well known, not unfrequently due to the physical structure and not to the chemical constituents of the metal. With respect to stone, we have in chalk and marble the same chemical substance, carbonate of lime, but existing under different physical conditions.

Before, however, entering upon the question of the structure and composition of building-stone, it may be well that we should fully understand the nature of the influences to which it is liable to be exposed, whether such influences are derived from the atmosphere under ordinary conditions, or from the more or less vitiated air of populous cities or manufacturing towns.

The subject of building-stone is one that, nearly thirty years ago, excited a great deal of public attention, owing to the alarming reports that were then spread about as to the lamentable condition of the stone used in the then newly-erected Houses of Parliament, at Westminster. In a leading article of a scientific journal of that time, the following statement was made with reference to the condition of the building: "In a century it will be — but we must not attempt to prophecy what it will be, for the probabilities are rather it will have ceased to be altogether." The excitement, however, gradually passed away as it became evident that the decay was confined to comparatively small portions of the structure, and that, at all events, the building was not likely to fall to pieces during the present century. The alarm, however, produced at least one good result, inasmuch as it led to an investigation into the nature of the stone, from which much useful information was derived upon a subject respecting which but little had been previously generally known. The records of the history of our globe afford evidence that the vast changes that have taken place at different periods, although frequently resulting from some sudden and violent convulsion, have been more generally due to the slow, gradual, but continuous action of natural forces over vast periods of time. In order to understand the cause of decay in stone, it is necessary that we should know something respecting the character and mode of action of the forces arising from atmospheric and climatic changes which exert their influence on everything around us, the immediate effects of which are apparently very feeble as compared with the magnitude of the results which they are ultimately capable of effecting.

These forces are partly of a mechanical and partly of a chemical nature. The former chiefly consist of those which result from the action of water which, with slow but certain progress, effects by its persistency changes so vast as to have no slight influence on the structure of the globe. That the hardest rocks will yield at length to the action of running water, their surfaces becoming rounded off by simple friction, is so well known as to have become proverbial. Besides the results produced by friction, water exerts a force of a most powerful disruptive tendency by the expansion which it undergoes in the act of solidifying or conversion into ice, of which fact some of us have probably been forcibly reminded during the winter season in a manner not conducive to our comfort by the bursting of our water-pipes, unless the necessary precautions had been taken to allow space for the increase in volume resulting from the freezing of the water,

The effects produced by frost in detaching large fragments, and sometimes very considerable masses, may be observed on any exposed surface of the softer rocks, and can scarcely fail to have attracted the attention of those who are in the habit of searching for fossils in the soft and friable cliffs of the lias formation. It is, however, in mountainous districts that we can best appreciate the enormous disruptive force that is produced from apparently so simple a cause, and the important part which water plays in the breaking up of the older rocks, and in the formation of sedimentary deposits resulting from their disintegration. All rocks are more or less traversed by natural joints and minute crevices into which water finds its way, and these, by the repeated expansion of the water in its expansion into ice, are gradually enlarged into fissures, until finally the detachment of pieces from the mass is effected. The weather-worn blocks which so frequently attract our attention, more especially in granite districts, from the curious and remarkable shapes which they assume, some of them being so evenly balanced as to form "logan" or logging-stones, owe their peculiar appearance to the wearing away of those portions of the rock that are most easily acted upon by exposure to the influence of air and moisture. The effects produced by the action of the weather, combined with the mechanical force of the waves, are so great as to produce very considerable erosion of the English coast. Going back no farther than the year 1815, we find by the Ordnance map that there were then standing at Langley, near Beachy Head, four martello towers which, at that time were all above high-water mark; these have since all been destroyed by the advancing waves, the ruins of two of them being still visible at half tide.

Within a period of a few hundred years the sites of former villages and farms have been covered by the sea, of which the old town of Cromer is an instance, and the rate at which the waves advance at several portions of the coast line has been estimated at two yards per annum. How little regard is generally paid to this coast erosion is shown by the fact that at a spot not far from Folkestone, upon which the sea is steadily encroaching, might have been seen, a short time ago, an advertisement-board drawing the attention of the public to the excellency of the situation as a site for building purposes.

Water, as we are aware, possesses very great solvent powers, but possibly we should scarcely be prepared to learn that the solid matter annually carried off in solution is estimated to amount, in some districts to as much as 140 tons from a square mile of surface.

The chemical changes effected by water are, to a great extent, due to the air which it holds in solution, and to the various accidental impurities it contains. The air, in its normal condition, consists of nearly twenty-one volumes of oxygen and rather more than seventy-nine volumes of nitrogen, together with small but variable quantities of carbonic acid. From experiments made a short time ago by Dr. Russel, it appears the purest country air contains about three volumns of carbonic acid in 10,000 volumes of air, and that on a fine summer day in the city of London the proportions will not be increased beyond four volumes; but on a still, foggy day it is much greater, and may be increased to ten volumes, whilst, in some cases as much as fourteen volumes have been found in a dense and long-continued fog. The impurities usually contained in a town atmosphere, such as sulphates and chlorides, are also largely increased in a foggy atmosphere.

The constituents of air are, however, dissolved in water as separate gases, and hence we find that the air contained in water differs materially in its composition from that of ordinary atmospheric air, the proportion of oxygen being increased from twenty-one volumes per cent to nearly thirty-four per cent, whilst the proportion of carbonic acid is increased to a much greater extent. It is evident that such air must have enlarged powers of oxidation, and be much more capable of bringing about other chemical changes, of which we have an example in the extraordinary powers exhibited by river-water in oxidizing the organic matters with which it is polluted. The effects produced by moisture upon some descriptions of shale, such as alum shales, containing large quantities of sulphur, as sulphide of iron, affords a striking example of the action of water as a carrier of oxygen. When shales of this description are piled up in heaps, and moistened, combination of the sulphur with the oxygen conveyed by the water takes place, and the heat developed by the chemical action thus commenced is sufficient to produce, in many cases, disintegration throughout the mass.

The oxidizing power of the air is also influenced by the small quantities of nitric-acid and ozone generally present, which, although never very large in amount, are greater at periods of electrical disturbance. Ozone may be regarded as a condensed form of oxygen. It is oxygen in an allotropic condition, in which form it possesses greatly increased chemical activity, ozone surpassing ordinary oxygen in this respect just as oxygen does atmospheric air, possessing the power of bleaching substances, such as indigo or vulcanized rubber, that withstand the influence of ordinary oxygen. Ozone may be recognized by its peculiar odor, which is frequently observable in working an ordinary electrical machine, and its presence in the atmosphere is detected by means of test papers dipped in a solution of potassium iodide and starch. The iodide is decomposed by the ozone, and the liberated iodine coming into contact with the starch, strikes the well-known blue color indicative of the presence of iodine. Ozone may be produced by means of a generator, which is made on the principle of a Leyden jar, consisting of a long glass tube, coated with tinfoil on the inside, and surrounded by another tube similarly coated on the outside. Through the space between the two tubes, a current of dry air or oxygen is passed, which becomes converted into ozone on connecting the inner and outer tinfoil coatings with the terminals of an electrical induction coil. The condensation which oxygen undergoes by its conversation into ozone is considerable, three volumes of oxygen being condensed into two volumes of

ozone. When ozone is exposed to a temperature of from 300° to 400° Fahr., it expands to its original bulk, and resumes the condition of ordinary oxygen.

Water penetrating as it does all rocks, to a greater or less extent in proportion to their porosity, is thus the means of bringing about great and very important changes which are included under the general term "weathering." The effects produced by rain in its passage through rocks are generally the results of oxidation, converting sulphides into sulphates, and ferrous into ferric salts or into peroxide of iron; the oxidation of salts of iron are the most striking on account of the change of color which they undergo. Water, however, owing to the organic matter which it takes up in its passage through the ground, sometimes exerts a reducing action, and the results produced are reversed. Gypsum or calcium sulphate is thus converted by the reducing effect of the organic matter into calcium sulphide, which is readily decomposed into calcium carbonate and sulphuretted hydrogen, the latter, by oxidation, yielding sulphur, and thus giving rise to deposits of limestone and sulphur. This reducing action of water may also be observed in the white spots and veins which sometimes occur in red sandstones.

The observations of Professor Geikie on the effects produced by this weathering upon the gravestones in some of the older burying-grounds of Edinburgh, are very interesting and instructive. Some of these tombstones are composed of limestone, others of granite and sandstone. In many of those composed of granite, traces of decay in some of the felspar crystals were detected, the polished surface having become gradually roughened, as the individual crystals had been more or less easily attacked. Some of the sandstones have proved to be remarkably durable, and seem in some instances likely to resist the ravages of time for a longer period than the granite. On a sandstone in Grey Friars' churchyard the chisel-marks are still distinguishable, after the lapse of 200 years, the letters of the inscription upon it remaining sharp and distinct, the only observable change consisting of a roughening of the surface of the stone on the sides most exposed to wind and rain. Sandstones possessing distinct lines of stratification exhibited a tendency to split up along those lines under the influence of the weather, and in one instance of a flagstone set an edge, although the lettering of the inscription remained sharp, yet in the short space of forty years large portions of the stone had scaled off, affording a striking example of the necessity of attending to the well-known rule, that stones should be laid on their natural bedding. Many of the marble monuments had undergone considerable decay; irregular channels had been worn, partly dependent for the direction they had taken upon the trickling rain, and partly on the form of the monumental carving, or on differences in the structure of the marble. The surface of one marble obelisk had, in the short period of sixteen years, become so rough and granular, that it might readily have been mistaken for sandstone. The extent to which these alterations had taken place depended upon the position of the stone as regards exposure to rain and to the prevailing winds.

In one instance, the marble had been dissolved away to the depth of a quarter of an inch, the inscription having become quite illegible, although the stone had not been erected for more than eighty years. The inscription on the tombstone of Professor Black, in which his friends record the genius of the discoverer of latent heat and carbonic-acid, has become partially illegible, and we may be sure that it never entered into their minds when expressing a wish to mark the resting-place of the distinguished Professor "by the marble whilst it should last," how short a period would be sufficient to show to what an extent their confidence had been misplaced. The experiments conducted by Professor Pfaff, of Erlangen, led him to the conclusion that the annual loss of granite and syenite might be estimated at about .008 millimetres in thickness, and that of limestone at .013 millimetres, the limestone experimented upon being the hard Solenhofen limestone near Munich, used for lithographic purposes. Those rocks which contain iron not in the condition of peroxide afford marked examples of the effects produced by this so-called "weathering process" on account of the changes in color which they frequently undergo; thus, *e. g.*, the light colored spathic iron ore from Alston moor in Cumberland, and from the Brendon hills in Somersetshire, is often more or less converted from a light-colored carbonate of the protoxide of iron into a brown-peroxide. Now any alteration of form by the oxidation of iron must obviously tend to disintegrate and break up the mass in which such alterations occur, and hence the presence of iron in a condition in which it is liable to oxidation is often a source of weakness. The presence of iron-pyrites in slates (when not in the form of cubical-crystals) is considered to be detrimental to their value. Iron-pyrites is most familiar to us in the form of cubical-crystals of a golden yellow, but it also occurs in rhombic-prisms of a paler color, as marcasite, and in radiated nodules which are more liable to decomposition, specimens of which in cabinet collections may often be observed to break up and fall to powder. The oxidation of metallic-iron, or rusting, as it is generally termed, is not quite so simple a process as might, at first sight, appear to be the case. It is not simply the result of the direct combination of iron with oxygen. Iron will remain bright in dry oxygen for an indefinite period of time, whilst we are only too familiar with the fact that iron rusts very rapidly when exposed to air under ordinary circumstances. It is probable that we do not yet fully realize what a serious effect on the durability of many of the iron structures that have sprung up within the last forty years may be produced by this liability of iron to rust, because a number of years must elapse before such massive structures, as many of them are, become sufficiently weakened to render them dangerous; although it would seem from Mr. Clark's report, made in 1878, relative to the condition of the Britannia tubular bridge, in reply to some alarming statements which had appeared as to the injuries it had sustained from the rusting of the iron, that where proper care is taken to preserve the iron, there need not be much ground for uneasiness, since the report states that during a period of twenty years the entire loss from the whole mass, about 10,500 tons, did not exceed one pound in weight.

[To be continued.]

BOOKS PAPERS

ARTISTS more than any other class of men, seem to suffer from the changeableness of human nature. The verdict of public opinion upon statesmen, upon commanders and upon scientific men, varies from age to age; but the grounds for the change are generally founded upon some rational basis — the discovery of fresh evidence of some sort. But the opinions passed upon artists and their work (I mean artists in the widest sense of the word) are simply based upon the taste of the day, which is as variable as the weather. There was a time not far distant, when Jane Austin's novels were seldom read; now, one is barely permitted to say that they are a little prim and tiresome. So, too, most of us can remember the violence with which we denounced David Cox and De Wint as belonging to what a great art-writer defined as the "Blottesque School;" and the enthusiasm with which we pursued Pre-Raphaeliteism. Now re-action has set in — we discard the latter, and the "slighter" our work, the finer we think it. Formerly we strained our eyes to see every leaf and to paint each blade of grass; now we screw up our eyes and try to ignore detail. This is all more or less fashion. Of course there is a positive good and a positive bad in art — but the bad is as often the fashion as the good. Even such meretricious work as that of Carlo Dolci and Sasso Ferrato has been admired by those who pretend to be connoisseurs, while on the other hand, Tintoretto, Rubens and Delacroix have been the victims of ever-shifting fashion.

Perhaps no painter has suffered more in this manner than François Boucher, "*le peintre des grâces.*" Extolled at the height of his reputation as the most *spirituel* of painters; he was called by others "*un corrupteur de la jeunesse,*" and "the author of the decadence of taste and even of morals." Both verdicts were equally false. Boucher had many merits as a painter, and although much of his work is objectionable from the moral point of view, sufficient remains of a high order to give him rank amongst the best artists of the eighteenth century. Nor was he answerable for the degradation of much of the art of his epoch. During the reigns of Louis XIV and XV a very different standard of morals existed, even amongst the best members of society from that of the present day; and although an artist ought to set an example, it is very difficult to determine whether the demand produces the supply, or the supply, the demand. The period was one of perpetual carnival for the rich; and its literature and art only reflected and portrayed the manners of the masquers. Honesty and uprightness were virtues all but unknown; modesty and religion were despised. Poverty and misery were ignored as much as homely every-day life. The myths of Greek mythology, gods and goddesses, sham shepherds and shepherdesses were the only subjects worthy of a painter's brush. Hypocrisy and selfishness reigned supreme; and the spectacle of Madam de Pompadour attending mass in her private chapel, the walls of which were decorated with religious subjects by Boucher, is an example of this rampant hypocrisy and depravity. But Boucher has been in and out of fashion oftener since his death than during his lifetime, and now, after being reviled for a generation, one of his works has been sold at Christie's for nearly £10,000! And this, too, a portrait of the Pompadour! So the world wags, and deceased Pompadours replenish exchequers which have been weakened and drained by their living sisters. But to this despicable class of humanity Pompadours are always interesting, whether in the flesh or on canvas. Such was the revulsion of feelings against Boucher during the first Empire (in itself not an over moral period) that Prud'hon, that most chaste painter of goddesses, was menaced with being considered a copyist of "*Boucher de ridicule mémoire, de Boucher maudit,*" and enjoined to quit that style before he became injurious to the schools. Another writer speaks of his drawings as "*fade, faux, et ennuyeux comme ses dessus de porte.*" This is all the grossest exaggeration. His work was not equal in grace to Watteau's, nor in realism to Chardin's; but in color and composition, and often in drawing, he was by no means their inferior. As decorative painting for drawing-rooms, his work still remains unique, and it is a pity it should not come into fashion again. The sombre coloring and the conventional designs which have been the rage for some years (decoration à la Burne Jones, William Morris and others) suit some rooms; but where light is scarce, and where frivolity reigns, Boucher's amours would be more suitable. One sees ceilings innumerable on the Continent painted in

[1] "*Les Artistes Célèbres: François Boucher,*" par André Michel. Rouam, Paris.

this style most effectively, and nothing can be prettier. Because we object to his sprawling goddesses, there can be no reason why we should abolish his little celestial children floating upon clouds.

François Boucher was born in 1703, and there seems to be some reason for supposing that his father painted in a humble manner, as he was the boy's first master. At seventeen he was a pupil of Lemoyne, but he seems to have become independent soon after. His life was uneventful and commonplace, passed between work and play. What spare moments he had (he worked twelve hours a day) were passed as was the time of his royal master, and of that master's friends, in the pursuit of pleasure as they understood it. The Pompadour was herself a sort of artist, etching plates from designs of Boucher, and she delighted in posing as a patron of Art. She "took up" Boucher, and he was only too willing to be patronized by a beautiful woman; but although he schemed all his life for a lucrative post about the court, it was only in his latter days that he became the King's "first painter."

Besides paintings, Boucher drew and etched and engraved, and, considering the number of books illustrated by him, as well as the long list of pictures, drawings and engravings, it is a marvel that, even working twelve hours a day, he could get through it all. His début as a painter seems to have been made in the streets. In those days it was the custom for young artists to hang their works on the draperies which were placed round the Place Dauphine and the Pont Neuf on the Fête Dieu. This was called the *Exposition de la Jeunesse*, and here, in 1725, Boucher exhibited a "Mercury" and several small pictures. In 1727 he went to Italy and seems to have been influenced by Albano and Pietro da Cortona; but although there is a certain similarity between the former and Boucher, the latter is a far better colorist. Setting aside all the pictures which are questionable, or have a *double entendre*, there yet remains a large number of works which, if somewhat frivolous in design, show the hand of a master. The series of "Jeux d'enfants" are charming in composition. "La balançoire" is a group of fat little children playing on the branch of a tree which they have placed across a rock. There is no attempt at idealizing; they are simply impish little people who belong to a world where clothes are not worn. But even Boucher's children have met with contempt from Diderot, who describes them as a numerous family where "*vous n'en trouverez pas un à employer aux actions réelles de la vie, à étudier sa leçon à lire, à écrire, à tiller du chanvre.*" And he wishes they would stay in their clouds. This is really hypercritical. Why in the world a painter should not be allowed to conceive a race of children free of wings, clouds, and schools one does not quite understand; and as regards common sense, they do not break its rules more than saints and angelic hosts.

But it was in decorative art that Boucher excelled, and to this day one may see a great many houses in which his panels still exist. Much, too, of the Gobelin and Beauvais tapestries were produced from his designs. Some of these are very charming — idyllic landscapes with flocks of sheep or goats, waterfalls, rustic bridges, and other accessories of pastoral life. The two "Pastorals" in the Louvre are amongst some of his best sylvan work. (Nos. 28, 29.)

When the mania came in for *chinoiseries* Boucher, of course, was ready to supply the demand, and amongst other things he painted the designs for the scenery of a ballet "L'Opérateur Chinois," which was produced at Madame de Pompadour's theatre at Belle Vue near Sèvres.

It is characteristic of the age and the men that when Cazes, Galloche, Restout, Dumont, Van Loo, Natoire, Colm de Vermont, Pierre Leclerc and Boucher competed for *cent jetons d'argent* and a *médaille d'or*, it was proposed by Boucher, Natoire, and Dumont that the prize should be divided amongst them "*afin d'éviter toute jalousie.*" Lenormant de Tourneheur wrote to Coypel upon the subject of this competition, which was to encourage talent and induce painters to "*s'appliquer plus qu'ils ne font présentiment,*" that he hoped that "*celui qui donnera les noms pour chacun des prix ne mette pas le sien.*" (The subject was the "Rape of Europa," Boucher's being now in the Louvre.)

When Reynolds was in Paris he visited Boucher and was surprised to find him at work upon a large picture without sketches or studies or model of any kind; and latterly, he seems to have worked in this fashion — he had not the time to do otherwise. Hence the conventionality of his work. He profited by fashion, and fashion destroyed his talent. But he amused himself in his own way, and he must have made money, for, at his death, his collection of pictures and *objets d'art* were sold for 720,427 livres.

Boucher died in 1770, the victim of the inevitable maladies which come to those who burn the candle at both ends. Had he been only an indefatigable worker he might have lived longer. But his day was passed, and some time before his death his reputation had gone. His light went out with that of his patroness, the Pompadour. His only worthy pupil was Honoré Fragonard, who saw the results of the lives of Louis XV, la Pompadour, and their despicable set. The Revolution set in and gave birth to a new style of art. Roman virtues became the fashion and David, like his relation, Boucher, profited thereby. Whether the cold, severe, inanimate Brutuses and Leonidases of David are greater as art than the amours of Boucher is questionable — at all events they are far more stagy, less real, and less living. Whatever may be said against the painter "*des Grâces,*" his flesh lives; but the battle of realism and idealism will go on to all time. By those of us who love color, and to whom technique is of more importance than subject, such painters as David and Ingres will never be fully appreciated, and their works will always appear lifeless and uninteresting.

A visitor to the Archives Nationales can find a subject for moralizing when he reads the last letter of Madame Elizabeth to Marie Antoinette and looks up at Boucher's "Offrande du Berger" upon the walls above. And in another room Love listens to the lessons of Mercury upon the walls; while in a glass case are the requisitions of Fouquier-Tinville, for an escort for the condemned, and the judgment of the Girondins, signed by David. Truly, as Victor Hugo says, "*ceci tua cela.*" If only the most guilty had been the chief sufferers, and those who set the example of brutality by the murder of Damiens, had been the first to expiate their crimes upon the scaffold! The condemnation of Boucher has been somewhat reversed in our time, and even before that, he had his defenders, amongst others David, who had known the painter in his youth and been helped by him. Speaking of the painter of the Graces, he calls him "*ce grand coupable,*" but "*s'il ignora la beauté de la ligne rigide et du style 'noble,' il eut du moins quelques qualités de grand prix qui ne s'apprennent pas à l'école.*" M. André Michel is to be commended for what one may call his "apology" of François Boucher. He is just, which all the painter's critics have not been; and it is time that Boucher should be judged fairly and without prejudice upon his own merits. S. BEALE.

IT is one of the peculiarities of art in general, as distinguished from the industries, that its resources and possibilities are never exhausted, and that there is practically no end to the variety of ways in which the artist may express his individuality. This fact was brought out more emphatically in past times than it is now. Among modern painters we seldom find a man who is a specialist in any one medium. Some painters, like Allongé, have made for themselves a special reputation, but as a rule artists seem to adhere by preference to paint. Doubtless they are right. Surely, there is no medium so adapted for study. Still, one cannot avoid a certain feeling of regret that some of the more delicate processes which were so much in favor in past times have now been almost neglected, especially as we find that whenever an artist has taken up any one medium and confined himself to that, if a man of any marked talent, his success was always very decided. Such was the case with Maurice Quentin de la Tour,[1] an artist who was almost unique in his productions, and unfortunately one who has had few followers, though every one, artist, amateur, and the uncultured, never fail to admire his work. He was born at St. Quentin the 5th of September, 1704. Of his early life we have no record any farther than that he was of a very ardent disposition, and got into a scrape which obliged him to leave his native land, and which was, no doubt, the making of the man, as he was obliged to travel on the Continent as well as in England, and was drawn into companionship with such artists as Van Dyck, Watteau, and Desportes, all of whom influenced him very much in his after life. We must remember, at this time Watteau reigned supreme in French art, and the society, the manners and the life of the upper classes of the people were all in that delightfully romantic condition which found its fitting exponent in Watteau's paintings. Delicacy, grace and beauty were the first requisites of a successful painter, and considering these facts, it is not strange that La Tour, on his return to Paris, by which time he seems to have acquired quite an art education, should have at once adopted pastel as his particular vehicle of expression. This medium was introduced into France in 1720 by a Venetian painter, Rosalba Carrierra, who had a knack — it could hardly be called more — of crayoning portraits and giving a charm to the effect which recommended her to all the ladies in society. She was in great demand, being even regarded so highly by professionals that, shortly after her arrival in Paris, she was unanimously elected a member of the Academy. But her talent was of a second order, and it was reserved for La Tour to use the medium in a masterly manner, at the same time evolving all the grace and beauty which had made the Venetian portraits so attractive.

It was in 1737 that La Tour exhibited for the first time in public, and during the thirty-seven years following he sent to the different *Salons* about one hundred and fifty pastel portraits. Our biographer does not tell us any of the details of the route by which La Tour was enabled to reach public favor, but we know that he became the intimate friend of Rousseau, Grimm, Voltaire, and others of that stamp, and was the universally received painter *à la mode.* Always a gallant, and a great favorite with the ladies of the licentious court of Louis XV, La Tour seems invariably to have chosen them for subjects, and with his marvellous facility, generally excellent drawing, the best of taste in pose and color, he was able to quite captivate, not only the lesser lights that shone around the throne, but even Madame de Pompadour herself, who condescended to entreat him again and again not to neglect her portrait, not to fail to do his best for her. Champfleury tells us one little incident which will at once illustrate the impetuous, unrestrained nature of La Tour, and the way in which he was accustomed to treat royal personages who sat for their portraits. He tells us that, after having been entreated for a long time to make the portrait of the favorite, La Tour finally agreed, upon the express condition that he should not be

[1] "*Les Artistes Célèbres; La Tour,*" par Champfleury. Paris: J. Rouam, Editeur.

interrupted by any one during the séance. Madame de Pompadour having accepted the arrangement, La Tour arrived at the stated time and began, according to his custom, to take off the buckles of his slippers, undo his gaiters, remove his collar, hang up his wig on the candle-sticks, and put on his painter's bonnet or hat. In this easy studio costume he began to draw, when Louis XV entered, Madame de Pompadour smiled. The king appeared somewhat astonished at the *sans façon* costume of the painter; La Tour makes up a face, rises, takes off his bonnet, "You promised me, Madame, that your door would remain closed." The king softly insists upon remaining. "It is impossible to obey your majesty," replies La Tour, "I will return when Madame will be alone." He carried off his wig, his gaiters, collar and hat, dressed himself in another room, and departed, not returning until several days afterward, when Madame de Pompadour had assured him he should not be interrupted in the future.

In his middle age La Tour came under the influence of a very celebrated singer at the opera, Mademoiselle Fel, who was his mistress for the greater portion of his life, and exercised a very salutary effect upon his impetuous uncontrollable nature. La Tour has left us several portraits of her whom he calls his divinity, and these, together with the contemporary documents, show that she was a woman of a great deal of force, and, though living in an age when ideas were much looser than now, possessed considerable integrity of character, and was a strong force in the life of the painter.

Le Tour lived to an advanced age, returning to his native town when about seventy, and in his old age gradually settling into second childhood. He never forgot his early artistic struggles, and before he died provided for a number of beneficient foundations in the way of pensions and prizes, some of which have remained intact ever since. He founded a prize for the Royal Academy of Painting and Sculpture in Paris, which was to be awarded each year. This prize, of a value of three hundred francs, was for *la demi figure peinte ou du torse*, and was instituted in 1776. It is awarded now every year to pupils of the École des Beaux-Arts. La Tour died in 1789.

The portraits painted by La Tour are not only full of life; they have a peculiar charm in that the faces seem always to be smiling, and it is this which makes them so thoroughly pleasing and enjoyable. With most of his seductive creations, the mouth is the happiest feature, and the sinuous termination of the lips, which are always made to curve a little at the corners, gives a piquancy to the expression such as is found in the works of very few portrait painters. The La Tour mouth is almost proverbial for its beautiful lines. Rarely, in his studies of women, and the same with young men, are the lips kept in a horizontal line. Nearly all of his portraits have just a little bend which is so pleasing in nature and which any daughter of Eve would feel so flattered to see in her own portrait. La Tour's success lay in that he was able to paint the ladies of his time, not, perhaps, as they were, though, for that matter, he was almost always a very accurate draughtsman, but rather, as they would wish to be; never in all his career did he make any woman look ugly. Naturally, his work was sought after, and it came to be almost a criterion of taste in feminine beauty as to whose portrait he should expose in the annual *Salon*, as his selection was considered an indication of what he himself thought the most beautiful face.

With all of his delicate, seductive art La Tour left very little tangible influence behind him. He painted to please a passing fashion, and while every one admires his delicate, clear-toned pastels, he has found few imitators, and, indeed, it is doubtful if his influence on art was any more lasting than that of Louis XV on the manners of modern society.

If there may be songs without words we see no reason why this wordless little publication[1] may not properly be styled an "essay." Its twelve small plates show, in a rather "Vedderesque" fashion, the evolution of the broom-corn in its passage from the humble and useful filaments familiar to the housewife to — well, we do not really know what is the final state that its graceful contortions really reach, though the last object to which they are applied is the frame of a mirror, which bears the inscribed legend *fronti nulla fides*.

It is a very skilful and interesting performance, and Mr. Colonna has presented his ideas in a very taking form, for one is sure to be attracted enough by the brilliant India cotton cover of his little album to pick it up for examination, and is equally sure to examine more than once the mute pages of the essayist, which are as eloquent to the Hindoo as to the Gothamite decorator. A score of similar albums — if the variations upon each chosen text were not too eccentric and far-fetched — would be an interesting possession for any one.

The French Academy.—Some curious statistics are published in the Paris *Revue Bleue* about the French Academy. Out of its 40 members there are 9 writers, 7 playwriters, 4 historians, 3 poets, 3 journalists, 2 philosophers, 2 lawyers, 1 economist, 1 cutter of isthmuses, 4 senators, 1 deputy and 1 bishop. One academician, M. Duruy, belongs to 3 classes of the Institute, and 9 belong to 2, namely, MM. de Lesseps, Jules Simon, d'Aumale, Bertrand, Pasteur, Renan, Boissier, Léon Say and Greard. As regards place of abode, 18 live north and 21 south of the Seine, and the Duc d'Aumale is in exile.

[1] "*Essay on Broom-Corn.*" By E. Colonna, 1887. To be had at the author's, in Dayton, O., U. S. A.

COMMUNICATIONS

THE INDIANAPOLIS SOLDIERS' MONUMENT.

Indianapolis, Ind., August 8, 1887.

To the Editors of the American Architect: —

Dear Sirs, — I am in receipt of the marked copy of your journal with the articles relating to our enterprise, and am much obliged to you for sending it, because it gives me an early opportunity to say that while, in the main, your positions are properly taken so far as they relate to competitions as usually conducted, they are, I trust, not so in respect to the one on which we are about to enter. I do not say this in any spirit of resistance to the tenor of your suggestions, which are unquestionably the outgrowth of intolerable experiences that have afflicted the architects and artists of this country in the past, but to state a fact. I was under the impression that in my former letter it had been made clear that the advertisement we first made was simply an announcement which had to be made "at once" in order to comply with the law, and, notwithstanding such features appear in it as the one requiring complete itemized estimates, etc., it was not looked upon as, in any important particular, a programme for the conduct of the competition. I find, however, upon reference to my letter-book, that I was not explicit enough in stating this, and therefore, state it now, with the addition, that competitors will be expected to be guided by the rules of the competition and the other matters of information to be furnished by this Board, and which the advertisement requests them to send for. While it is true that in the law there are requirements specifically set forth, like the one calling for itemized estimates, etc., that were probably introduced without knowledge on the part of legislators of what their effect would be, and the composition of the Board of Experts as prescribed by the Act was not provided for in the best way, it is also true that the spirit and intent of the Act, and, in general, its provisions, are of such a character that the Commission can find a safe course and get the best advice that can be had, at least in this country, and adopt such rules and offer such inducements as may bring good designs to the competition.

The real work of preparing for the competition was begun after the preliminary advertisement was issued. The Board have selected Prof. William R. Ware as one of the Experts, and will endeavor with his aid and that of others to formulate a code of instructions that may, as they hope, "make their competition a memorable event in the artistic world," to quote from your article, and as they have hoped from the beginning to be able to do.

The reason why the Board did not take the course indicated in your article as undoubtedly the best way, namely, to engage at once an architect and a sculptor of the highest reputation, was not because they were hampered and did not have the authority to do so, nor because they wished to avoid an appearance of favoritism, but because, for one thing, they wished to do their best to make this competition memorable, and furthermore, for the higher reason, that because of the unusual magnitude of the work compared with any other works of its character in this country, and the intricate and high requirements that made the selection of an artist and architect a matter requiring unusual judgment and absolute knowledge of art and of men renowned in art, they believe they stand a better chance of getting a great design by instituting a competition, if they succeed in making the terms thereof reasonable and attractive.

When it is considered that the history of an interior State, the character of her people, and of the services of the men whose deeds this monument must commemorate, or the sentiments and conditions this work should symbolize, can hardly be familiar to the great sculptors of the world, or even to the architects and sculptors of this country, what hope could any commission have that in selecting any one, without first acquiring knowledge of many, that they would be certain to pick the right man, even though the selection was made from those most distinguished by past achievements?

That there is among architects a very wide-spread dissatisfaction with the manner in which competitions for public work have heretofore been managed may militate against the success of this one, but will probably not prevent the Commissioners from ultimately obtaining a noble design. That it will be difficult to induce the best men to take part in this competition is undeniable, but that it will be impossible remains to be seen, and depends, perhaps, upon conditions that may prove to be very different from any hitherto realized in other enterprises. And even if the competition fails, the other way still remains, although the Commission will not probably try that way till every earnest effort to obtain a great result by competitions high in character shall fail.

There is to be said, also, that it is very unlikely that in Germany or France the competition would fail, and yet it is very seldom that compensation at all equivalent to the $1,500 to $5,000 that designs may cost in this country is ever offered in those countries to competitors, save to the authors of the victorious designs. The distinction achieved by success in such a competition there is so much greater and of so much greater value and import that, of course, artists can afford to do more to compass it. But neither that fact, nor the evils that have characterized the unbusiness-like, or ignorant, or other undesirable management of competitions in this country

in the past, would seem to justify the elimination of the principle of right competition from the relations that must hereafter exist between artists and State or private patrons in this country, where munificent commissions are so rapidly increasing in numbers and in possibilities.

In regard to the rewards awaiting the author of the successful design in the Indiana competition, the Commissioners construe the law as mandatory that he shall be the supervising architect, or the artist to carry out his own design. As to the money compensation, while the provision in respect to an architect may not be entirely satisfactory to a first-class man, being five per cent on the cost price, $220,000, the distinction to be derived from success in this particular case will be far greater, provided the competition is high in character and the art in the work is noble, than it would be in a competition for any ordinary public building to cost $220,000 only. And this consideration will weigh with European sculptors, and should weigh with American sculptors or architects, unless all great efforts in art, in order to be great in results, are to find their stimulus only gauged by the amount of money in prospect. While it may be a good business principle never to do any work that is not adequately paid for, had that principle actuated the great artists of the past, the world would have probably been the poorer and many triumphs of architecture and art, instead of enriching the present and covering their authors with enduring fame, would have been but idle dreams. It is right, of course, that a great artist should not be haggled with and should be amply rewarded, but have the money rewards of great artists ever been commensurate with their merits, or can they ever be adequate and the highest compensation for the benefits that genius may confer upon the world? I remain very truly yours,

J. F. Gookins, *Sec'y S. S. & S. M. Com.*

[We wish the Commission complete success in their endeavors. It will be remembered that we only spoke of the matter under reserve, not knowing what the stipulation of the competition, as established by the Commission, might be. As to the question asked in the last clause of Mr. Gookins's letter, it is only fair to say that "the money rewards of great artists" are now, in most civilized countries, very large. It is true, as the letter says, that much of the best work in the world has been done for love, or for small pay, and we should be sorry to see artists become so mercenary as to measure their effort by its reward; but this does not alter the fact that a Millais, a Leighton, a Herkomer, a Street, a Waterhouse, or a Scott in England, or a Meissonnier, a Garnier, or Bonnat in France, or a Ferstel in Germany, live surrounded by every refined comfort that wealth and rank can procure. — Eds. American Architect.]

Indianapolis, Ind., August 10, 1887.

To the Editors of the American Architect: —

Dear Sirs, — Allow me to commend you upon your very able article on the "Indiana Soldiers' Monument," in the issue of August 6, of your valuable paper. Undoubtedly, it will have very wholesome results, and goes to illustrate the value of your paper, and I, for one, duly appreciate the benefit of having such a weapon for the defence of our interests and the legitimate rights of the profession. The Soldiers' Monument question has been occupying the minds of the people for quite a while, and during the last two years has been assuming some definite shape. Collections and donations have been made until about $25,000 have been accumulated, and, during the session of the last Legislature, an effort for an additional appropriation of $200,000 was made, which was successful, although there was some opposition. It has long been my desire to inform you upon so important a matter, but the circumstances and schemes which were connected with it, were of such a nature that I thought it best to give the whole as little publicity as possible. There had been for a long time a design prepared by one of our local tomb-stone cutters which there was real danger would be accepted, not only through the striking appropriateness of the design, but mainly through the good influence this gentleman would bring to bear. However, since the State has taken the matter in hand it has also assumed a different shape. The Governor has appointed a Commission of five — three Republicans and two Democrats. The Commissioners seem to be sincere in their desire to secure a good piece of work, but, as you have stated, they are certainly not in a fair way to secure such.

With others, I have endeavored to influence the Commissioners to make this a memorable event in the art world, which, in fact, would be the only way of securing a first-rate piece of work, by way of reaching a first-rate man. They were, however, very hurried in their action in sending out the objectionable advertisements, and have already come to grief at your hand. At last, however, they have accepted our first counsel, of either consulting you or Professor Ware. I have been informed that they have chosen the latter, he having accepted, and will be here this week. This latter conclusion was reached, I believe, under the impression that Professor Ware would be more likely to have time to come out for a personal interview. We can only hope that the Commission will give him autocratic right in the whole matter, since there are some very queer phantoms in the air, one member desiring a monument several hundred feet high, provided with an elevator. The constitution of the jury is, unfortunately, provided for in the bill of appropriation, and is not optional with the Commission.

The location is in the Circle, in the centre of the city. The Circle has at utmost 400 feet diameter and is closely bordered by high houses.

The time set for the expiration of the competition is, in my estimation, very short; and, although this was impressed on the Commission, they seem to think this very ample, which, with their request to furnish itemized estimates, only proves their ignorance of the value and the amount of work they are asking for. There is, indeed, no need for so hurried action, for, although the State has appropriated the money, the Legislature has made no provision for the same, and the execution cannot be begun for the next two years, the present preliminaries being carried on by a small fund of subscriptions. These are the principal facts in the matter, and I hope Professor Ware will succeed in making everything good again, and bring the Commissioners back into good standing with the profession, for we trust their mistakes were made rather through ignorance on their part than a lack of desire to secure the "first-rate man."

Yours truly, Monument.

A SLIPPERY ROOF — AND CLIENTS.

Clinton, Iowa, August 12, 1887.

To the Editors of the American Architect: —

Dear Sirs, — Seeing several articles, from time to time, in your valued publication in regard to commissions, and the like, I take the liberty of asking you a question in regard to a case I have in hand, hoping to hear from you through your regular issue. The case is like this: I made designs for two business blocks, of similar design, for two men. The designs were accepted, and it was arranged that we should put on a slate roof, and, as everything was to be made as cheap as possible so they could make some money out of the investment, I thought it would do if there were no snow-guards put into the slate, thinking what snow did slide off would not hurt, as we have very little snow here, comparatively, but said nothing about snow-guards to the parties, as it was taken for granted they knew that the snow would necessarily slide off, as one of the parties building the larger block already had a building covered with slate, of about the same pitch, and the putting on of snow-guards would have cost about $5 per square. The building not being completed until late in the fall, there were several snow-storms before its completion, and they saw the snow slide off, they refused to pay me the two-thirds of my commission due at completion of the building, until the roofs were fixed someway so they would not shed snow onto the sidewalks. I then procured samples of Folsom's snow-guards, and offered to apply to a section of one of the roofs, at my own expense, and if they proved satisfactory I should be paid the balance of my commission and cost of guards and applying same, but they refused to let me prove to them that the snow-guard was what they desired, and they will not do anything themselves, and still refuse to pay me balance due, and the matter has stood this way for nine months with no prospect of a settlement. I have not tried to force them to pay, as they are men of means and would possibly put me off as long as possible in case of a suit.

Can you suggest any way for me to get balance of commission without going to law. They claim damage to the amount of balance due. Do you think it proper for them to do this, as they were continually cautioning me to make the buildings cost as little as possible? And when I tried to save everywhere possible that they should come on to me this way.

Hoping to hear from you soon, I am, respectfully yours,

A Subscriber.

[This looks like an attempt to rob the architect under a very flimsy pretext. If the law of the locality provides that snow from roofs must be prevented from sliding off in certain cases, the architect is generally expected to know the law and to advise his clients accordingly, or to make the necessary arrangements for complying with the rule, in default of any contrary instructions from his client; but if the matter is not regulated by a higher power, there is no more reason why the architect should, without instructions, provide in his specifications for snow-guards than for any other expensive luxury. In this case the instructions were to make the buildings as cheap as possible. It is not pretended that the architect forgot about the snow-guards, or any other indispensable part of the construction, but only that he followed the instructions as he understood them, instead of divining something in the minds of his clients, which they said nothing to him about, either when they were explaining to him the sort of building they wanted, or when they saw it in course of construction, and which they did not make known to him until his work was all done, and he asked for his pay. In our opinion, a judge would dispose very briefly of such a plea, and "Subscriber" has been altogether too amiable in troubling himself to get samples of snow-guards to show such clients. We know well enough the cost and annoyance of law-suits, particularly in this country, where technicalities give, as "Subscriber" suggests, undue opportunities for rich people to delay and annoy poorer ones who seek relief; but it may comfort "Subscriber" to know that rich people of unscrupulous disposition often designedly overrate their influence with courts, and their power of preventing justice to the injury of those who oppose them; and we should say, from his statement, that he stood a very good chance of collecting his bill, by process of law, with interest and costs, and without much delay. Of course, to a professional man, who must work day after day, and hour after hour, to earn his living, the loss of the time necessary for preparing and trying his suit is something serious, but this cannot at present be helped. Some time we hope to see architects relieved of this, the greatest obstacle in the way of enforcing payment from those persons who calculate all their chances for avoiding their obligations, by the establishment of professional societies like the French "Mutual Defence Fund," the executive committee of which, on being convinced that one of its members has a just claim for professional service, intervenes, either to effect a settlement out of court, or, if that is refused, to prosecute the claim to the extent of the law through its regular attorneys, without expense to the complainant, and with very little trouble. — Eds. American Architect.]

NOTES & CLIPPINGS

THE SIDON DISCOVERIES.—The *London Times* gives this summary of the Sidon discoveries, as to which American missionaries have already sent home some details: 1. The chamber of the eastern side of the square excavation (which is truly orientated) contained two sarcophagi in white marble. One of these is perfectly plain, and the other is ornamented with sculptures of the richest and most beautiful kind, already roughly described. This is the chamber which is surrounded by an arcade adorned with eighteen mourning figures in relief, dressed in Greek costume, each in a different pose. It is not stated whether the arcade itself or any portion of it has been removed. 2. The south chamber had two sarcophagi, one in black marble, plain, and the other in white, with splendid sculptures. 3. The western chamber had one sarcophagus in white, mummy shaped. But this chamber proved to be the vestibule to another containing four sarcophagi, one of which was the richest and finest of all those found. The walls of this chamber also are richly decorated. 4. The chamber on the north has two plain, mummy-shaped sarcophagi. On removing the débris which covered the ground two other chambers were found, one on either side, on a lower level. One of these contained a small tomb; the other, four white marble sarcophagi. Under the eastern chamber also was found another containing a sarcophagus of black stone, in which were the teeth, bones and hair of a woman. All these tombs had been violated by breaking a corner of the coffin lid. But in carrying out the works for the removal of the sarcophagi a chamber was found in which, at first nothing was remarked but two fine bronze candelabra, each about five feet in height. The flooring of this chamber, however, on examination, proved to consist of a bed of great stones laid with the utmost care. Beneath these were a second bed of stones, and then a third, and, under all, thus carefully covered up and hidden away, a great monolith covering an opening in the rock. In this deep chamber was found a splendid sarcophagus in black stone, resembling that of the King Eshmunazar in the Louvre. It was also, which is more important, provided with an inscription in Phœnician, eight lines in length. The inscription has not yet reached us. In the *Badier* (published once a week at Beyrout, in French and Arabic) a translation is proposed, which is copied for what it is worth. Probably considerable modifications will be made in it when the inscription is in the hands of scholars; "I, Talnite, Priest of Astarte and King of Sidon, son of Eshmunazar, Priest of Astarte and King of Sidon, lying in this tomb, say: Come not to open my tomb; there is here neither gold nor silver nor treasure. He who will open this tomb will have no prosperity under the sun, and shall not find repose in the grave." There seems to have been little else of importance found in these chambers; some gold buttons, a coin or two, collars, rings and bracelets, two bronze candelabra, and some terra-cotta lamps exhaust the list so far as can at present be learned. Something, however, will doubtless have to be added; and it is, meanwhile, interesting to note that His Excellency Hamdi Bey proposes to re-commence operations in the early spring of next year.

WORMS THAT EAT STEEL RAILS.—We give the following from the *Cologne Gazette* for what it is worth: The existence has just been discovered of a detestable microbe which feeds upon iron with as much gluttony as the phylloxera upon the vine. Some time ago the greatest consternation existed among the engineers employed on the railway at Hagen by the accidents occurring always at the same place, proving that some terrible defect must exist either in the material or in the construction of the rails. The German Government directed an inquiry to be made, and a commission of surveillance to be formed for the purpose of maintaining constant watch at the spot where the accidents—one of them attended with loss of life—had occurred. It was not, however, until after six months had elapsed that the surface of the rails appeared to be corroded, as if by acid, to the extent of 100 yards. The rail was taken up and broken, and it was literally hollowed out by a thin, gray worm, to which the qualification of "railoverous" was assigned, and by which name it is to be classed in natural history. The worm is said to be two centimetres in length, and of the size of the prong of a silver fork in circumference. It is of a light gray color, and on the head carries two little glands filled with a corrosive secretion which is ejected every ten minutes upon the iron. This liquid renders the iron soft and spongy, and of the color of rust, and it is then greedily devoured by the insect. "There is no exaggeration," says the official report of the commission, "in the assertion that this creature, for its kind, is one of the most voracious kind, for it has devoured 36 kilogrammes of rail in a fortnight."

COLOR-BLINDNESS ON GERMAN RAILWAYS.—Some interesting results have been yielded by an extensive investigation into the prevalence of color-blindness on German railways. The inquiry, which has lasted several years—the latest data having been obtained on July 1, 1886—was extended to 79 railways. Of 104,743 persons tested from April 1, 1882, to July 1, 1886, 850, or 0.81 per cent were found to be color-blind. Of 239,726 persons tested up to July of last year, 1,934, or 0.81 per cent were color-blind, while of 145,456 officials and other servants employed on the 79 railways on July 1, 1886, 100 were entirely and 441 partially color-blind, a percentage of 0.37. The methods of testing were chiefly the Stilling method (by means of color plates) and the Holmgren method (by means of colored woollen threads); but the Daae, Cohn, Schmidt, and Rimpler methods were also adopted. In 16,201 cases the test was repeated, and 305 times did the results differ from former results. The officials of German railways who are color-blind have been given duties in the discharge of which their incapacity can have no ill result, so that there is no danger in their continued employment.—*New York Evening Post.*

GLOBE LIGHTNING IN FRANCE.—In a note communicated to the Academy by the Minister of Posts and Telegraphs, some extraordinary events are described which happened in connection with a thunderstorm in the neighborhood of Mortrée (Orne) on April 24. A cow was being milked in a stable, when the animal suddenly stood on its hind legs, jamming its fore feet between the bars of the rack, and at the same instant the affrighted peasant saw a ball of fire enter the open door, pass between the legs of the cow, and disappear without explosion and without damage. In the street outside the ground was at the same time thickly covered with fragments of a soft, grayish-white mineral substance, varying in size from that of a pea to a walnut. No analysis of the substance is given. During the same storm a length of 150 metres of telegraph wire was destroyed, the wire being broken up in numerous short fragments. The discharge entered the telegraph office at Mortrée, and passed to earth through the lightning protector with a tremendous detonation, but without doing any damage whatever. At the same time a portion of the discharge seems to have passed through the brick wall of the house, perforating several holes, and hurling a quantity of plaster to the other side of the road.—*Electrician.*

WHY SNOW DESTROYS MARBLE STATUARY.—The results of the examination of snow taken from different places in Munich and its neighborhood, by Mr. Sendtner, says the *Pharmaceutical Journal* (London), would seem to indicate not only that snow has a considerable faculty for absorbing sulphurous acid from the atmosphere, but that the absorption goes on continuously for some time. Mr. Sendtner ascertained that, on one day when snow fell, sulphurous and sulphuric acids were present in it fairly in equal portions, but on the second day almost all the sulphurous acid had been ozonized to sulphuric acid. In the vicinity of chimneys and gas-works the absorption would, of course, be greater. This great absorptive power toward sulphurous and sulphuric acids is considered of great practical interest as explaining the destructive influence of snow upon marble statuary.

TRADE SURVEYS

UNEXPECTED sources of demand for everything which enters into building and railroad, mill and shop furnishing have been springing up since the opening of business in the spring. All of the great and little industries have been rounding themselves up, and in so doing have been developing demands of very wide proportions. Railroad managers and the builders of new roads continue to lead in the placing of orders for all kinds of supplies. The locomotive-builders have, since August 1, secured unexpectedly large orders, and for first-class passenger engines the prices have been as much as ten per cent better. The Western agricultural works have ordered large quantities of material and machinery. Mining requirements have become an important factor in the machinery market, especially for mining supplies for Lake Superior region. Chicago houses have placed large orders for special machinery since the opening of summer. There has been also a very good distribution of Western and Southern orders for castings, lathes, belting, mill equipments, besides orders for building-material to fill requirements not supplied beyond August. Selling agents for all large machinery-makers and manufacturers of all kinds of building-material report greater activity during this summer than they have ever had. Pipe of every kind has been quite active, but within two months capacity has over-reached itself, and the renewal of the pipe-makers' combination in September is uncertain. The workers in glass have settled details in nearly all branches for the coming year. Merchant steel makers' productive capacity, great as it is, will not be beyond the probable demand. Bridge-builders have large orders to place for angles, tees, beams, and channels, and the capacity, from present indications, will be barely equal to the pressing demands.

The iron and steel rolling-mills all over the country are doing a remarkably good summer business, and the blast-furnace output, though as high as 120,000 tons per week, shows no accumulation. The New England textile manufacturers feel more hopeful over stronger prices. Trade combinations are maintained, and many influences unite to prevent undue competition. The margin of profit in cotton mills will probably improve. The varied manufacturing interests of the New England and Middle States have everything in their favor. Coal and coke production in Pennsylvania is at the normal limits, and is increasing in the two Virginias, while railroad companies will expend money liberally to develop rich territory, supply better and additional terminal facilities, and develop new markets. The lumber trade is apparently quiet, but large transactions are being arranged for in Chicago and the Northwest, based upon a supposed strengthening of prices a little later. The distribution from Western to Eastern points throughout the summer has been in keeping with the heavy building demand. The statistics of the building trades throughout the East show that there has been no cessation of activity. There is a demand for house and shop room in cities and in suburban and rural localities which encourages investments and stimulates enterprise. No one section of the country is leading in building enterprise. Work is abundant everywhere, and much work for next year is already talked of, such as bank, school and warehouse work. The railroads will be heavy buyers of building-material next year, and a great deal of elevated railroad and bridge and dock, as well as shop work, is to be undertaken. In order to prevent heavy rail importations mill prices for standard sections have been reduced to $37 per ton, and, if necessary, less will be taken. The monetary situation is satisfactory on the surface. The banks have calls for all available, loanable funds. There are possibilities of higher prices for accommodation loans. The repetition of past mistakes is being guarded against. Perhaps too much reliance is being placed on government assistance to help out in times of trouble. At our present progress the business interests will certainly stand in great need of the friendly watchfulness of the general government. At the same time the financial condition of the country is sound. Money is abundant. Speculation, pure and simple, is at a low ebb. Cornerers of every class are being severely disciplined, and the country is guaranteed an abundance of all the elements of health and wealth. Production is being steadily expanded, but buyers are still crying, "more, more." The fall trade is opening up under the most favorable conditions, and so far as the sharpest wits of the counting-room and the shop can see, the country is moving towards better conditions and a larger trade.

THE AMERICAN ARCHITECT AND BUILDING NEWS.

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CONTENTS

AN astounding story comes to us from a place which shall, for the present, be nameless. This anonymous town undertook, not long ago, to build a city-hall. A competition was instituted, into which entered an architect, or firm of architects not very widely known in the profession, but of considerable experience in State and municipal buildings. The work was commenced, and is still going on, but, as usually happens, some one's interest or envy, or disposition to meddle, was the occasion, not long ago, of an investigation by a committee of the City Government, into the manner of conducting it, in which it transpired incidentally that the architects mentioned had before the competition made a contract with an ex-official, promising to pay him fifteen hundred dollars "for his influence in securing the adoption of their plans for the new City-hall by the City Council." Moreover, it turned out that the money had been duly paid. No one seems to have thought much of the matter; but one evening the Committee on Public Buildings and Grounds, which had conducted the previous investigation, took a few leisure moments to satisfy their languid curiosity; and the parties most interested being present, called up the recipient of the fifteen hundred dollars and asked him what he did to earn it. His memory proved weak upon this point, but he produced the contract, which proved to be in the hand-writing of the Mayor. This potentate, being one of the company, explained that he drew up the agreement "in his capacity as a lawyer, and not as Mayor of Anonyma." The Committee then mildly adopted a resolution exonerating everybody from all blame, and immediately elected the receiver of the fifteen hundred dollars keeper of the magnificent new park which forms one of the principal glories of the town.

TO speak with moderation, this case has a strong flavor of the vilest practices known to the architectural profession. Next to tampering with a ballot-box, a crime which, in our humble opinion, should be punished with death, we can conceive of nothing more mean and contemptible than for a man claiming science and skill to enter a contest intended to try the abilities of the participants, in order that the best may be chosen, and try, before the award is made, to corrupt the judges with money and influence. The lowest clodhopper among all our sixty million people would be hooted out of his native town, or dressed in tar and feathers and carried out of it on a rail, if he should enter a race, and hire some one to trip his antagonist, or stand up with the gloves and strike foul blows; yet a man claiming to be a gentleman and an artist can hire a go-between to filch away the prize of fair rivalry from other gentlemen and artists, without, apparently, exciting a single unfavorable remark from the witnesses of his conduct. As to the Mayor who arranged the transaction we have nothing to say, the antics of Mayors being beyond our comprehension; but we would suggest to the tax-payers of the town that a comparison of the sum paid to a single lobbyist for a favorable award with the compensation offered to the successful competitor would be of considerable interest.

THE sad accident in New York, the other day, by which several girls were killed or injured through the rapid descent of an elevator, deserves a little more intelligent attention than the daily papers are able to give it. Probably most architects, in reading the accounts, have wondered at the failure of the safety-catches, made by a firm so highly esteemed as Messrs. Otis Brothers, to stop the car, and, so far as can be judged by the evidence, although a failure of the kind would hardly occur once in a thousand times, this seems to have been the thousandth time. The elevator is said to have been equipped with a safety-catch on a well-known and generally-approved principle, by which the lifting-ropes pass through the "yoke" of the platform, and are attached to the middle of an inverted spring, of bow shape, which is placed on the underside of the timber. The outer ends of the spring move freely, and are engaged with L-shaped levers, the outer ends of which are formed into pawls, shaped to fit the ratchets in the iron guides. So long as the car hangs suspended from the rope, its weight rests on the spring, which is flattened by the pressure, and the ends, being pushed outward, push with them the upper ends of the L-shaped levers, and thus hold back the lower ends which form the pawls. As the car moves up and down, the pawls are, therefore, maintained a fraction of an inch away from the ratchets, but ready, if the spring should be released by the breaking of a rope, to dart instantaneously into their places and hold the car safe. If the rope of the New York elevator had broken, this would have been the effect, the spring instantly assuming its normal form, and throwing out the pawls so as to stop the car. Unfortunately, it did not break, but one or two teeth of the pinion, by which the rapid motion of the shaft is transformed into the slow movement of the winding drum, broke off. This left the drum free to turn the wrong way, and it did so, allowing the hoisting-rope to uncoil, and the car to descend. If the drum had broken itself entirely loose, it would probably have turned so freely as to relax the spring and throw out the pawls, but the obstruction caused by the fragments of the pinion, the dragging of the rope, and, perhaps, the friction of the brake which is usually provided for use in certain contingencies, seems to have checked the descent so much as to keep the car pulling strongly on the rope, thus flattening the spring, and preventing the pawls from flying out. It is obvious that the spring must be so adjusted that the relaxation due to the normal downward movement shall not operate the catch, and in this case the speed of descent, although great enough to be fatal, remained just within the margin necessarily left to prevent heavy loads from being caught in the midst of the downward journey.

THE people of Ohio propose to hold an exhibition in Columbus, the capital of the State, in September, 1888, to celebrate the one hundredth anniversary of the settlement of the State. Among other things, works of art are to be exhibited, and the directors invite contributions from all quarters. The arrangements made for this department are very liberal. Agents are to be appointed in Boston, New York, Philadelphia and Chicago, to collect pictures and statues, and those approved will be packed, transported to Columbus, insured and returned, free of expense to their owners, while works for sale will be shown by a competent person, and sold, if possible, without charge for commission. The directors point out that two-thirds of the people of the Union live within one day's journey of Columbus, and if the exhibition is as good as it seems likely to be, it ought to have many visitors. Architectural designs, sketches and photographs are particularly invited, and it is to be hoped that many will be sent. If we may make a suggestion, we should like to see a special exhibition of photographs of buildings. It must be confessed that collections of architectural drawings do not attract many people out of the profession, and even in Paris and London the architectural rooms at the *Salon* and the Royal Academy are deserted, while the adjoining apartments, hung with ordinary pictures, are crowded. A collection of photographs of architectural subjects would be a novelty in exhibitions. We know that most photographs of buildings taken in

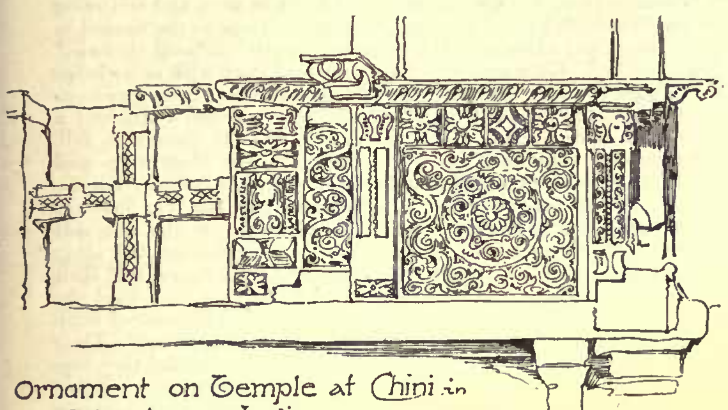
this country are very bad, presenting generally a distorted view of the least interesting portion of the structure, without contrast of light and shadow, and with no attempt at preparing the building for its picture; but the idea of showing them would encourage architects either to take views of their own work, or to direct the photographer deputed to do so; and an immense amount of interesting material, particularly in the shape of detail, might be secured in this way which would never be shown in drawings. Those persons, either artists or architects, who are disposed to contribute, may obtain information desired from the Commissioner, Mr. Walter S. Goodnough, 101 Hamilton Avenue, Columbus, Ohio.

BUILDERS may be interested to know the items of cost of a small Paris house, which we find given in detail in *La Semaine des Constructeurs.* The house is one of two, which form the end of a block in a good quarter of Paris, and the design, by M. Renault, seemed so pretty to M. Noé, the skilful sketcher whose drawings beautify that excellent journal, that he has given them both, with the plans of the two principal floors. The lot on which each stands covers about a thousand square feet, being some twenty-four feet wide by forty-five deep. The building is about twenty-five feet deep, leaving a garden — not a "back yard,"— twenty by twenty-four, which is laid out in tiny walks and flower-beds. The entrance door is nearly in the middle of the front, and opens into a hall, about four feet wide, which extends to the dining-room door. On one side of the hall is the parlor, about ten feet by fourteen, with a fireplace in it, and on the other an office, about seven by eight feet, with a corner fireplace, and beyond this the stairs, which go up at right angles with the hall, as is often the case in our city houses. At the foot of the stairs is a little free space, into which open both the parlor and dining-room doors, while the door to the kitchen, which adjoins the dining-room, opens into the same place, but is retired somewhat under the stairs. The dining-room and kitchen occupy the whole of the garden front, the former being about as large as the parlor, while the kitchen is about eight and one-half by ten feet, which is a tolerably good size for a French kitchen. A casement window opens from the dining-room to a flight of steps descending to the garden; and the kitchen has also a small flight to its own corner, besides stairs to the cellar, going down under the main stairs. The second story has two large bed-rooms and two small rooms, and a water-closet, lighted from the outside; and the third story, in the Mansard roof, presumably about the same accommodation. All of the large chambers, besides the dining-room, parlor and office, have open fireplaces. Each house is prettily treated in brick and stone, with stone cornices, and a good deal of carved stone detail; and the cost of each, complete, was less than five thousand dollars, exclusive of the land. It must be remembered that building is very expensive in Paris, and the work could probably have been done here with less cut-stone, but more elaborate woodwork, for the same amount, or less, but few of our city houses can show as compact planning, or so many pleasant rooms for so small a sum. In Paris the expense was increased by a bad foundation, which required two hundred and thirty-six dollars' worth of "consolidation" for each house before it could be built upon. Independent of this, the excavation cost fifty-six dollars, the mason-work and tile floors two thousand and fifty; the beams and framing three hundred and twenty; the roofing, gutters, plumbing and gas-fitting three hundred and thirty-eight; the hardware, including pretty iron balconies to two of the front windows, four hundred and eighty-six; the joinery six hundred and eight; the mantels ninety; the fireplaces and range two hundred and twenty; the drains eighty-six, the bells thirty-two; the Venetian blinds fifty-two, and the carving sixty-eight.

IT is very pleasant, as well as encouraging, to find one's work appreciated, and we are glad to call the attention of our younger readers to the praise bestowed by so brilliant a journal as *La Semaine des Constructeurs* upon Mr. Harold B. Warren's beautiful pen-and-ink drawing of the grand staircase of the Examination Schools building at Oxford, which appeared not long ago in the *Sanitary Engineer*, and is reproduced as a full-page illustration by the French journal. Although Mr. Warren is an artist, not an architect, he is quite familiar with architectural drawing, and has distinguished himself by his sympathy with such subjects; so that it is not surprising to find the sketch, although treated with a skill in light and shade which marks the trained artist, full of that feeling of solidity, and comprehension of structure which architects like to impress upon their drawings. The staircase itself is, perhaps, the crowning beauty of one of the most interesting of modern buildings. Entering by the central door, the visitor finds himself in a hall, not very vast in dimensions, but made picturesque by a balcony on one side, while the construction, all of solid, cream-white stone, gives it a peculiarly satisfying effect. At one end of the hall is the staircase, also of stone, ascending to an arcaded corridor, which communicates with the various examination-rooms. The disposition is simply the common one, of a fireproof hall in two stories, opening in each into rooms of wood-construction, but carried out in the noblest spirit. The stairs themselves are, of course, stone, ascending by several turns, with square landings, in the free, picturesque manner which characterizes the building; and the balustrade, instead of imitating the wreathed ironwork of a French stair, or the Classic balusters of an Italian one, consists of a series of panels, alternately large, pierced with a pretty pattern, and small, containing plates of precious marble. To prevent the panels from looking "spotty," a band of colored stone is carried along the whole length of the balustrade, just beneath them, moulded to form a plinth, and dark-marble shafts carry the arcade above. This gives effect enough to support strong color in the panels, and it is freely used, one panel, in particular, containing a magnificent piece of blue Labradorite. The whole, though not more costly than the staircases of many of our office and bank buildings, has an interest seldom found in such structures, and is well worth studying.

THE *Sanitary News* makes a good suggestion in regard to the construction of public buildings, which, in this country, are almost invariably remarkable for the disregard shown in them for the simplest rules of health. As the *Sanitary News* says, this is to be attributed in a great degree, perhaps principally, to the cleverness of Legislatures, which delight in uniting a long list of requirements for such buildings with an appropriation which they know to be inadequate, apparently under the idea that some one will be thus deluded into signing a contract to do the work at a loss. Unfortunately for this idea, architects and builders usually know quite as much of their own business as legislators do, and those, particularly, who care to meddle with public buildings have brought the art of getting over work cheaply, in case of need, to a perfection which leaves little to be desired; and the announcement of a programme for a building which ought to cost a million dollars, but the expense of which is restricted by law to half that amount, gives them just the opportunity they need — not for sacrificing themselves as victims either to legislative astuteness or their own public spirit, but for making a good deal of money out of a contract which would ruin men more scrupulous or less ingenious. The most vigilant supervision of a large building is ineffectual against a determination on the part of an experienced contractor to scamp his work; and architects as well as sanitary engineers have plenty of stories to tell about the abominations which are frequently disclosed by expert examination of the most costly structures. Some of these, which are inherent in the plan, and are due more to the hurry of a cheap and underpaid architect to get over his work with as little expenditure of time and study as possible than to premeditated malice, may easily be detected by experts; and a statute of Michigan provides that all plans for the alteration or construction of public buildings shall be submitted to the State Board of Health, and approved, before being carried into execution. With such excellent Boards of Health as are found in most of our States, this rule would be of great value; and, if it were possible, we think that all school-houses, both for public and private schools, and all hospitals, whether maintained at the public expense or by private subscription, should be included among the structures which it should be forbidden to erect until the plans for them had been examined and approved by the highest sanitary authority of the State. In the older States, particularly, the condition, even of public school-houses, is sufficiently disgraceful, but many private schools are held in rooms which would not be tolerated in public school-houses in the same locality; while, as medical men can testify, a great deal of money is just now likely to be worse than wasted on small hospitals which lack the first requisites of such buildings, and, when they get older, will cause quite as much sickness as they will cure. Nothing but supervision of the plans will correct this, and such supervision should be made compulsory.

THE MEXICAN NATIONAL LIBRARY.



THE "Reform" in Mexico, as it is called, is a chapter in Mexican history generally very little understood. This is not the place to attempt a full explanation of it, but a brief statement of the facts in the case, as suggested by the building now used as the National Library, may not be out of place. In 1859 Benito Juarez became the "Constitutional President" of Mexico (as he is always called), by means which, though interesting, are too complicated to be related here. There was another president — or anti-president as he is now called, since the cause of Juarez triumphed in the end — at the time in possession of the capital, and after various attempts to establish himself elsewhere, Juarez finally formed a home for his Government in Vera Cruz. The anti-president in the city of Mexico was under the control of the Church, and his Government derived its support from the Church. Such were the circumstances, under which Juarez, the plucky little Indian who had risen step by step from a mean birthplace in an Indian hamlet in the mountains of Oaxaca to the presidential chair, issued a decree "Nationalizing" — that is confiscating all the property belonging to the Church, and suppressing all monastic orders throughout the country. It seems strange that such a measure should be so widely regarded as a Protestant triumph over Romanism. Juarez was not a Protestant Christian. He was not aiming a blow at Romanism as distinct from Protestantism or Judaism. He hated the Church, that was all. He hated any institution that held money which would be useful for the carrying on of his Government, and more than all he hated any institution that supported a Government in opposition to his, and occupied the capital to his exclusion. He fought, not Rome in particular, for he knew no other Church, but he fought Christianity. His feeble and indirect encouragement of Protestantism was because he saw in it, as he supposed, an enemy of the established religion. In his eyes Protestantism was a modified form of infidelity.

It is the result of the "Reform" laws of Juarez upon the architecture of Mexico that attracts the attention of many visitors to that city. Juarez managed to overthrow the rival Government in the capital and fight his way up to the city of Mexico. There, in the most brutal manner, the "Reform" laws were executed. The monasteries were closed and dismantled. Everything that could be quickly converted into money was taken. Thus plate, jewels and paintings were removed. Altars were destroyed and bells taken from towers. Twenty millions of dollars are said to have been realized by these measures. And yet the Mexican Government remained as deeply in debt as before. The property was turned over to secular uses. That is why one may see in the city of Mexico (the blow fell heavier upon the Church in that city than elsewhere), so many buildings bearing crosses, sacred monograms and other marks and symbols denoting that they once belonged to the Church, but which are now devoted to secular, not to say in some cases, *base* uses.

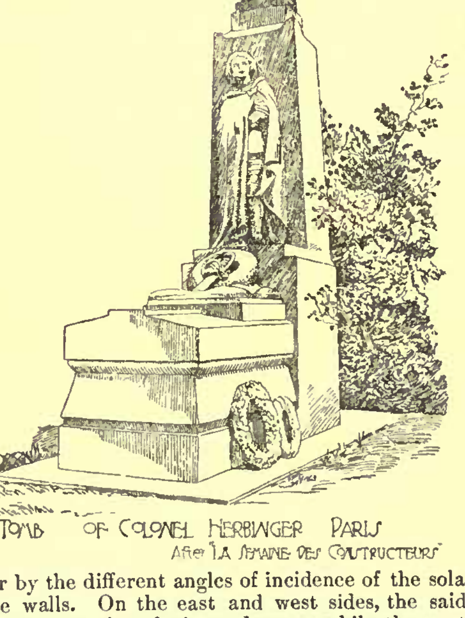
Among the monasteries undergoing this experience in the Mexican capital was that of San Agustin. The order of San Agustin came to Mexico in 1533, and shortly afterwards built a church which was destroyed by fire in 1676, and immediately afterwards the walls of the present building were erected upon the same site. When the fury of the "Reform" broke upon the Church in the capital, San Agustin was dismantled and gutted. A beautiful choir, of the form of that now existing in the Cathedral, which had cost upwards of two hundred thousand dollars was sold for three thousand dollars. The towers were destroyed. After the restoration of the Republic, upon the defeat of Maximilian and the Imperialists, it was decided to found a National Library in Mexico out of the spoils from the several monasteries, for these monasteries had been rich in literary as well as art treasures, and what else could the Government do with the thousands of volumes in vellum binding? The Church of San Agustin was selected as the most suitable to be made the permanent home of this library. Thus in the words of an indignant priest of my acquaintance, "The Mexican Government robbed the Church of buildings and of books, and putting the latter into one of the former, founded the *Bibliotheca Nacional* (National Library), and got the reputation of being the patron of letters and of encouraging literature."

The building was adapted to its present use at considerable expense. The exterior of the main building, seems by careful comparison with an old print in my possession, to have undergone no less changes than the interior. The basso relievo of the patron saint over the main entrance is all that remains to indicate that the building was once a church. A chapel of the *Tercer Orden* (Third Order, — lay members of the order) older than the church, in the rear of the main building, remains about as it was, having survived the fire which destroyed the first church, and also the devastations of the "Reform." It is a quaint bit of architecture, a Greek cross in form, and is made a sort of lumber-room for unclassified books. The library itself consists of about one hundred and fifty thousand books. It is rich in every department of literature, though naturally strongest in theology and colonial history, owing to its original source.

In a niche where was once a side entrance to the church, stands a large statue of Minerva. The library contains sixteen noble statues of colossal size, intended to represent the Fathers of Learning. They include Confucius, Homer, Plato, Aristophanes, Cicero, Virgil, Isaiah, St. Paul, Origen, Cuvier, Humboldt, and others. The grounds about the building are beautifully laid out. The posts of the iron railing surrounding the whole are surmounted by busts of Mexicans celebrated in the field of letters or science. There are nineteen. They include the celebrated Aztec poet Netzahualcayotl, and Aztec historian Ixolilxochitl, thus testifying how intensely *Mexican* the Mexicans are in their tastes and sympathies.

A block beyond the National Library on the opposite side of the street is a building which escapes the attention of most tourists, though it deserves some notice. It is a plain building now occupied as a storehouse by a mercantile concern. Its front wall is marked by a marble slab, "To the memory of Alexander Von Humboldt who lived in the house in the year 1803." The slab was inserted in the wall "on the one hundredth anniversary of his birth, September 14, 1869, by the German residents in Mexico." But this tribute to the memory of Humboldt is not characteristic of the Germans alone. The Mexicans are fond of his memory, and many are the means by which they seek to testify their appreciation of his interest in their country. ARTHUR HOWARD NOLL.

HOW WE SHOULD PLACE OUR HOUSES.



TOMB OF COLONEL HERBINGER PARIS
After LA SEMAINE DES CONSTRUCTEURS

IT was Karl Vogt, the eminent scientist of Geneva, Switzerland, who, by experiment, established the fact that, leaving the north side of a building out of the question, the south side is found during the summer months to be always the coolest, the east side following next in degree of temperature, while the west side he found to be the warmest. The direct effect of the solar rays upon the eastern and western walls of a house he found to be greatly stronger than upon the southern walls, this difference being accounted for by the different angles of incidence of the solar rays falling upon the walls. On the east and west sides, the said angle reaches its maxmimum size of ninety degrees, while the south walls are struck at an acute angle, hence the effect is much slighter. Vogt for the first time called attention to the problem of computing scientifically how our dwelling-shouses should be placed to insure for them a sufficient quantity of solar heat and light. Although the idea would not seem to be of much practical value, when applied to our customary city dwellings, surrounded, as they are, by other buildings, it must be conceded, that in its application to detached dwellings, it is deserving of careful consideration at the hands of the professional architect.

As long as nineteen hundred years ago, Vitruvius, the Roman architect, laid stress on the principle that, in planning cities the streets must not be laid parallel with the direction of the prevailing atmospherical currents. In Germany, the prevailing currents are north-east and south-west; hence her towns, if laid out on the rectangular plan, should have streets running from east to west and from north to south. This plan has actually been followed in a number

of cases, for instance, the cities of Karlsruhe, Mannheim, Darmstadt and others. Supposing a house so placed, it is evident that the prevailing north-east winds must strike the sides of the house at angles of incidence averaging forty-five degrees. Other winds striking the walls squarely or nearly so, are usually of short duration, blowing only for a few hours at one time.

It will be observed that, if we locate our houses on the principle advocated by Virtuvius, we are, at the same time, fulfilling the requirements demanded by Professor Vogt. During the summer months, the sun rising in the north-east and setting in the north-west, the east and west walls of a house will be heated to a greater, and the south wall to a lesser degree, since the rays of the sun then being at its great declination, fall more obliquely upon the latter than they do upon the former. On the other hand, during the winter months, the sun rising in the south-east and setting in the south-west, it is the south wall which is exposed to rays thrown upon it almost at right angles by the sun which then is at its minimum declination, whilst both east and west walls receive oblique rays only. Hence, if your house is so planned, that one side greatly exceeds in length the other, place its long side on a line running from east to west to insure for the same greater warmth in winter and less heat in summer, whilst the short side can better afford to be the cooler side in winter and the hotter one in summer, just because it is the shorter side.

It may be objected that, as there will be a long side combining the advantages of its southward position in hot and cold weather, so will there be a correspondingly long northern side receiving no sun during any time of the year, besides offering an extended surface to cold north-easterly winds. To this we answer, that it is impracticable to devise a plan that will combine all the advantages sought. By placing a rectangular house with its long side running from south to north, a more uniform distribution of the heating effect of the solar rays, and the different sides, may perhaps be obtained in winter, but — and here we have to touch upon another important factor governing the designing architect — the long side of the building so placed would then receive a much smaller amount of light than it would get by facing south.

It is, therefore, the desire to obtain the greatest possible amount of sunlight which causes men to place the long sides of their houses so as to face south, and thus to instinctively obey the law discovered by the scientist. In one class of buildings, the noblest one — churches, this rule has from olden times been recognized and strictly adhered to. Since man began to erect houses to God, up to the churches of the present day, it has been the favorite plan to build these edifices running from east to west. We are well aware that archæologists and art-critics have tried to explain this custom as emanating from a desire to place the altar nearest to the rising sun. But this motive alone would scarcely have asserted itself so continuously for centuries, had not the necessity of supplying churches with the greatest amount of light obtainable, caused that favorite plan to be adhered to. Thus, early religious sentiment and every-day practical need have combined to establish the rule, observed ever since, in locating churches, and the same rule, viz., that their long sides should face south and north respectively, should, wherever possible, be observed in the planning of our dwelling-houses. — *Heinrich Becker in the Deutsche Bauzeitung.*

PARIS CHURCHES.[1] — V.

ST. GERMAIN L'AUXERROIS.



From la Revue des Arts Decoratifs

BETWEEN the years 420 and 430 the ancient British church became infected with the heresy of Pelagianism, and the orthodox clergy, being unable to stay its progress, sent to Gaul desiring assistance. Thereupon a synod of the Gallican church was held, and it was determined to send Germanus, bishop of Auxerre, and Lupus, bishop of Troyes, to confute the heretics. The date assigned to this event by Prosper, a contemporary writer, is 429; but he makes no allusion to Lupus, whose participation in the mission rests upon the evidence of Constantius of Lyons, the biographer of St. Germanus. This Lupus was the author of "*A Defence of the Catholic Faith,*" a book which was of much use to Cranmer and Ridley at the time of the Reformation. The meeting appointed for the public disputation with the Pelagians is supposed to have taken place at Verulam (now St. Alban's, Hertfordshire), in 429; and according to the Venerable Bede's account, the heretics came to the council in great pomp, and advocated their cause with much "inflated rhetoric." But to no end. Germanus and Lupus silenced them with overwhelming arguments, and they were utterly discomfited. Bede's account is so quaint, and shows so great a difference between a fifth and a nineteenth century council, that it is worth while to quote it in full. "An immense multitude was there assembled with their wives and children. The people stood round as spectators and judges; but the parties present differed much in appearance; on the one side was divine faith, on the other human presumption; on the one side piety, on the other pride; on the one side Pelagius, on the other Christ. The most holy priests Germanus and Lupus permitted their adversaries to speak first, who long took up the time and filled the ears with empty words. Then the venerable prelates poured forth the torrent of their apostolical and evangelical eloquence. Their discourse was interspersed with scriptural sentences, and they supported their most weighty assertions by reading the written testimonies of famous writers. Vanity was convinced, and perfidiousness confuted; so, that at every objection made against them, not being able to reply, they confessed their errors. The people, who were judges, could scarce refrain from violence, but signified their judgment by their acclamations."

It is worth noting that at this time the *people were the judges in matters theological;* rather a different state of things from that which is now the custom at Rome and other places. After this, Germanus and his companion seem to have helped the Britons in a war against the Saxons and Picts, and by a simple stratagem routed the enemy. Germanus assembled the British troops in a hollow, surrounded by hills, and enjoined his followers to shout "Alleluia" three times. This they did, and the echo taking up the sound, produced such an effect upon the enemy that they took flight for fear of the multitude which they thought had come out against them. This "Alleluiatic Victory" is related by Constantius and Bede, and in later times by Fuller, but some authorities doubt its truth. At the same time the neighborhood of Mæsgarmon, in Flintshire, where the battle is supposed to have been fought, retains names of places which seem to have some connection with the memory of St. Germanus. After this victory the good bishop returned to his own country, but in 447 the Pelagians again becoming aggressive, he took a second journey to Britain, and this time not only baffled the heretics, but banished them. Germanus seems to have reformed the British Church, and modelled it upon the Gallican; for it was about his time, and no doubt, through his influence that parochial churches were founded in country places; the rural populations having previously depended upon missionaries from the towns for their spiritual teaching. Germanus also established schools of learning in Britain, and is thought by some persons to have introduced the Gallican liturgy. During the Roman occupation of Britain there were professors of Greek and Latin in all the chief cities of the country; but after the withdrawal of the Roman forces it became difficult to keep up these professorships. Hence the foundation of schools of learning, otherwise monasteries, was suggested by St. Germanus; and to this end he consecrated Dubricius, archbishop of Llandaff, and Daniel, bishop of Bangor. The former founded colleges at Hentland-on-the-Wye (where he had a thousand pupils), and Llancarfen, or Llanfeiltrin, Caerworgorn, and Caerleon. The word *bangor* in Welsh is simply a name for any college, and towards the end of the fifth century all the Christian societies began to assume that epitaph, *ban*, high, *côr* circle or congregation. The word is written variously (in MSS.), Ban Cor, Banchor, or Bangor. Bangor Garmon, or the College of Germanus, at Llanveiltrin, in Glamorgan, was founded by him in 460. Little is known of the internal regulations of these colleges, but the discipline instituted by St. Columba, about a hundred years later was very severe. Religious offices were held three times durlng the day, and as often during the night. Each day office consisted of prayers and three psalms, and in the night ones, from October to February, the monks were to chant thirty-six psalms and twelve anthems. That St. Germanus was a remarkable man there is no doubt, as we also owe the discovery of Ste. Geneviève to his foresight; for, when he saw her at Nanterre, on his way to Britain, he was so impressed by her piety that he consecrated her to the service of God.

The church in Paris was probably founded in commemoration of some miracle performed by the bishop during his sojourn in that city; or in his memory, which was held in great esteem by his namesake, St. Germain de Paris. That its origin is very early is certain, as we find that King Childebert and Queen Ultrogothe enriched it with gifts of various kinds. This early church was probably circular, as it was then called St. Germain le Rond; but in 886 it was utterly destroyed during the Norman invasion. It was in this first church that St. Landry, bishop of Paris, was buried. Originally, a chapter composed of a dean, a singer or precentor, thirteen canons, and eleven chaplains served the church, and it ranked immediately after Notre Dame, to which it was affiliated in 1744. Since that time it has been only a parish church.

Near the church are the Quai and Place de l'École, which owe their names to a public school of great celebrity, which was established about the time of Charlemagne. The church was rebuilt by King Robert, and again in the twelfth century it was entirely reconstructed. In 1831 it was so disastrously "restored" that half its original beauty has departed, although a later restoration has, to a

[1] Continued from No. 596, page 136.

certain extent, rectified the damage done by the nineteenth-century Vandals.

The tower is all that remains of the twelfth century; the principal door, the choir, and the apse are of the thirteenth; the porch, the greater part of the façade, the nave and aisles, and the chapels of the *chêvet* are of the fifteenth and sixteenth century. The cloister which surrounded the church has disappeared, as also the dean's house which stood in the space between the church and the Louvre. It was in traversing the cloisters of St. Germain that Admiral Coligny was shot, and it was the great bell of the church which gave the signal for the massacre of St. Bartholomew. St. Germain was the parish church of the Louvre and Tuileries, and many of the royal children were baptised there; while the kings went there in great state to perform their paschal duties.

The portico projects in front of the three principal west doors, and is the work of Master Jean Gaussel. It was constructed in 1435, and it is a mass of very beautiful carving. Some of the corbels are examples of the grotesque imagery of the period. The interior was decorated with frescos some years ago, but they are in a dismal, peeling condition. The central doorway is of the thirteenth century; the two side ones are of the fifteenth century. The whole is decorated with statues of various saints — amongst others St. Germain, St. Vincent, and Ste. Geneviève holding her candle, which a hideous little demon is trying to blow out. Round the tympanum, the subject of which is the Last Judgment, are the Wise and Foolish Virgins, the Apostles and the Martyrs. Abraham sits on one side holding a napkin on which are three little souls; while on the other is an infernal cauldron containing three lost souls (one mitred), and two horrible demons — one tormenting a soul with a whip, the other throwing a poor creature into the flames, having already torn his flesh into shreds. The gargoyles are peculiarly grotesque: a grinning savage is being ejected from the jaws of a hippopotamus; a man carries a hooded ape on his shoulders; and a showman is making a monkey dance. A corbel shows us a quantity of rats persecuted by a cat — the rats being the wicked who are consumed by the demon.

The exterior of the apse is disfigured by an arrangement of late date, a series of little rooms built of wood, and placed in front of one entire window, a wooden staircase leading up to them. It is an extraordinary fact that such a disfigurement to a church should have been allowed, and that Catholics do not protest against the profanity, as well as the Vandalism that permits the erection to remain.

The interior of the church has been all but ruined by the "restoration" of 1831. The old columns were fluted after a Classic pattern, the mouldings of the capitals being destroyed, and converted into garlands or festoons of flowers. The arches were disfigured as much as possible, and the whole nave deformed into a Classic affair. The only part which remains in its original condition is the apse, with its chapels, and the chapel of the Blessed Virgin. The latter is a gem, with its clustered columns and foliated capitals.

Formerly the choir was enclosed by a splendid *jubé*, the combined work of Pierre Lescot and Jean Goujon. Portions of the bas-relief of this — "The Entombment," and the "Four Evangelists" — are in the Renaissance Sculpture Museum of the Louvre. Had the modern possessors of the church only pulled this down they might have been forgiven, but they did not rest until they had appointed Bacarit to "purify" the church of its *barbaric Gothique*. Unfortunately for the reputation of the Academicians of 1745, we, in these days, can only look upon *their* transformation as far worse than barbaric.

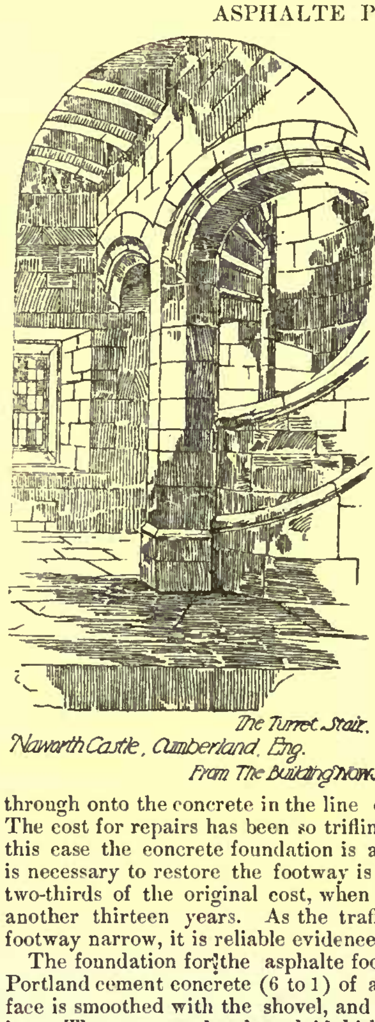
The chapels of the *chevet* have niches in the wall surmounted by round-headed arches and containing statues. There are in all thirteen chapels, but some of them now form the sacristy and the north door, the exterior of which is a good specimen of Renaissance work. Of the old glass little remains earlier than the fifteenth and sixteenth centuries. I imagine the good "artists" in 1728 scraping the paint off the vaulting and taking out the stained glass to make the church lighter! But happily the rose-windows of the two transepts, four lights of the south aisle, and two of the north aisle still remain; but these are only of the sixteenth century, and consequently are not in the best taste. Some have Gothic and some Renaissance surroundings, but the color is, if rather bright, clear and rich. Unfortunately, time has obliterated many of the heads and hands; but enough remains to read the subjects. There are a great many modern windows, but except those in imitation of the ones in the Ste. Chapelle, by MM. Lassus and Didron, they are of little artistic value. M. Lassus was the architect who superintended all the later restorations and decorations.

The chapel of the Blessed Virgin is a little church in itself, with stalls, organ, pulpit, screen and altar, all richly decorated. The reredos is a tree of Jesse which surrounds the Virgin with its branches. This is in stone, of the fourteenth century, and comes from a church in Champagne. Some restorations in 1738 brought to light a curious sixteenth-century wall-painting, representing a cemetery with the graves giving up their dead to the sound of the angels' trumpets. Three statues were also found of the same date as the chapel, and serve as the retable of the altar: they represent the Blessed Virgin sitting, and probably St. Germain and St. Vincent (who are united in all the decorations of this church), standing on each side of her. The *banc d'œuvre*, which is a sort of pew in front of the pulpit for the clergy during sermon, was executed in 1684 by Mercier, from drawings of Lebrun. It is handsome in its way, but utterly out of keeping with the rest of the church. It is composed of Ionic columns supporting a huge baldachino; and probably looked its best when it was filled by royal personages on high festivals and state occasions.

Amongst a crowd of courtiers and statesmen were the tombs of Malherbe, the poet, André Dacier, the *savant*, the painters Coypel, Houasse, Stella and Santerre; the sculptors Sarazin, Desjardins, and Coyzevox; the medallist Warin, the goldsmith Balin, the engraver Sylvestre, the architects Levau and Dorbay, the geographer Sanson, and the Comte de Caylus; but all these have disappeared. Of those which remain are two chancellors of France, Magnier, who died in 1635, and d'Aligre, who died in 1677; two statues which come from the mausoleum, which the house of Rostaing formerly had at St. Germain's; the epitaph of a Mortemarte, Duchess of Lesdiguières, who died in 1740, and a few modern ones of no value. But the grandest tomb is that which Charles V erected to the memory of his jester. Sauval speaks of this as grander than that of Du Guesclin at St. Denis. The pedestal was of black marble supporting a recumbant figure the size of life; the hands and head were of alabaster, the body of white marble, painted. It served as the model of the tomb erected by Hennequin de la Croix in 1375 to another jester, Thévenin, in the church of St. Maurice de Senlis; but both have been destroyed. A few fragments of the many monuments which the church formerly contained may be seen in the Louvre.

In conclusion, I commend to the notice of students some of the capitals of the south aisle of the nave, and the corbels and brackets of the porches. As examples of the quaint, grotesque tastes of Mediæval sculptors, they are unique. Verily, those early artists were humorists of the first order; but unfortunately, like their brethren of the pen, they often spoiled their work by indulgence of their taste for coarse and gross jokes. S. Beale.

ASPHALTE PAVING.



The Turret Stair. Naworth Castle, Cumberland, Eng. From The Building News.

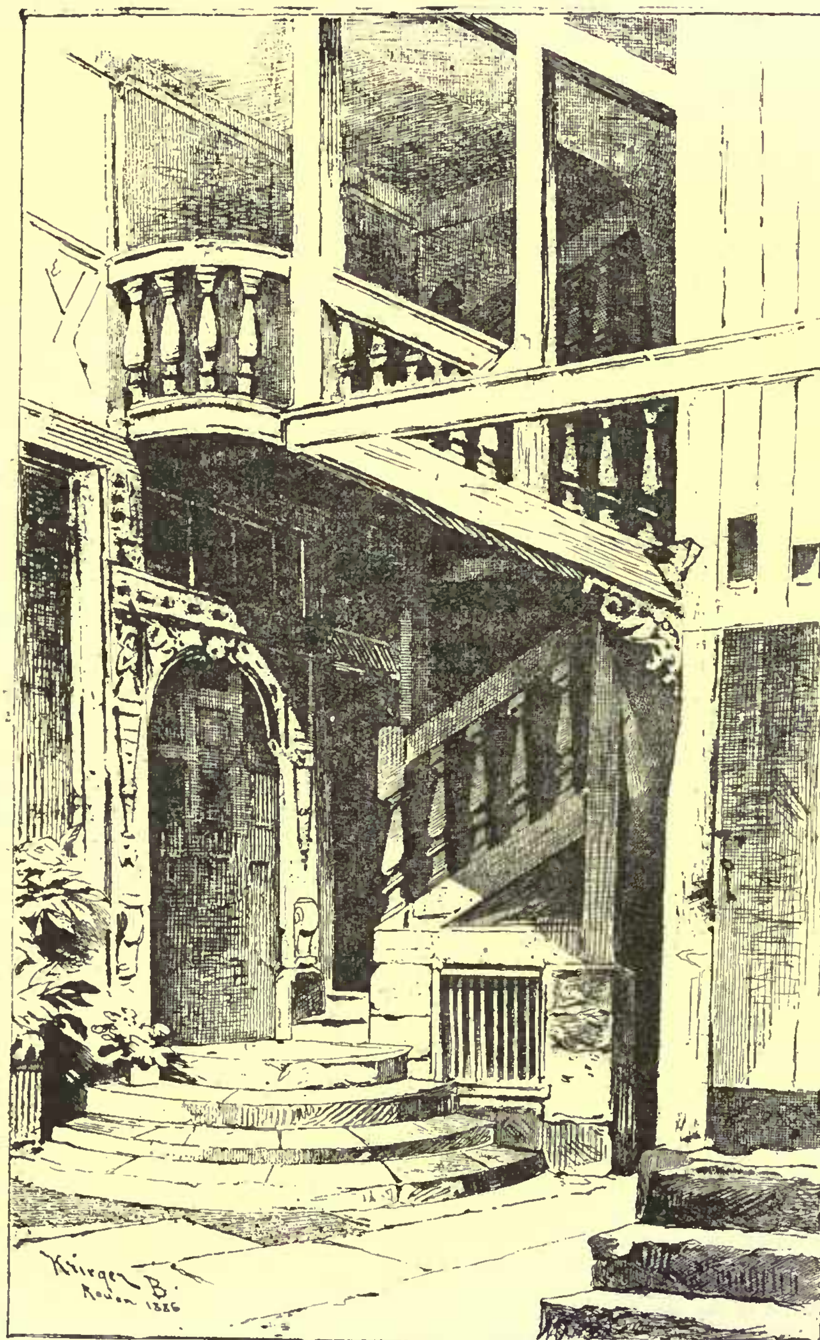
The following extracts are taken from a paper by Mr. G. B. Strachan read at the recent Congress of Municipal and Sanitary Engineers, at Leicester, England.

In Chelsea there are 16½ miles of footways paved with mastic asphalte, having an area of 68,290 square yards. On the Queen's Park Estate there are 41,500 square yards, which have been laid five years, and which are now in good condition, not having cost one penny for repairs. In King's-road, at Walpole street, a length has been laid for seven years. The foot traffic over it is 7,500 persons in eighteen hours. At the end of the first five years it was cut open, and the wear was found to be such as had reduced the thickness to a spare ⅞ of an inch, the original thickness being 1 inch full. On the east side of New Bond street a length of mastic asphalte was laid thirteen years ago between Oxford street and Conduit street, the thickness being ¾ of an inch. The asphalte is now wearing through onto the concrete in the line of traffic at the forecourt line. The cost for repairs has been so trifling that it may be neglected. In this case the concrete foundation is as sound as before, and all that is necessary to restore the footway is to relay the asphalte at about two-thirds of the original cost, when the pavement will be good for another thirteen years. As the traffic here is very severe and the footway narrow, it is reliable evidence of the durability of asphalte.

The foundation for the asphalte footway is made with 3 inches of Portland cement concrete (6 to 1) of a very good quality. The surface is smoothed with the shovel, and four days are allowed for drying. The concrete has been laid hitherto without any joints. The mastic asphalte is floated over this surface, and the path is then completed. Mastic asphalte does not show any cracks on the surface. The concrete foundation, when the asphalte is removed, shows the irregular, tree-like cracks all along its length, branching from the curb to the back line, but the elasticity of the mastic asphalte is sufficient to resist the tearing action of the concrete as it contracts.

A study of the asphalte question resolves itself principally into a study of the movements of concrete when laid in long lengths, narrow widths, and small thicknesses. The writer inclines to the opinion that concrete has in itself a small power of contraction, apart from any considerations of temperature. The experiments of Dyckerhoff which show that neat cement (slow setting) had an average expansive power over twelve months of .0734 per cent, and

quick-setting cements of .2019 per cent, and that concrete (3 to 1, sand) had an expansive power of .0264 per cent (slow setting) and .0320 per cent (quick setting), seem to show the contrary to be the case. The writer laid down a length of concrete (6 to 1, ballast) 52 feet long, 12 inches wide, and 3 inches thick, under a shed which had an open front, but so that the sun did not touch the concrete. The strip was laid on sand so as to give it freedom of movement. Another strip 26 feet long, of the same width and thickness (3 to 1, pebbles), and a third of the same dimensions (3 to 1, sand) were also laid under the same conditions. The only movement discernible, at the end of one month, was a slight contraction in length in all the samples. The uniform experience of concretes under asphalte is that cracks occur, which would tend to show that contraction and not expansion is the rule. At the same time, the writer has experience that concretes do expand, but this he attributes to the action of temperature. It is no uncommon thing to see the surface of an asphalte path raised crosswise in an irregular line, as though a small tree root were under it. In every case where the asphalte has been uncovered at these points by the writer, he has found the concrete crushed and the concrete on the falling level thrusting itself under the concrete on the rising level. This effect is most marked on hot days. In January last the writer laid some thousands of feet of asphalte path in St. Luke's Gardens, Chelsea. The sun is on it all day, and during the hot weather at the beginning of June, the number and size of these raised lines was astonishing. Shortly after midday they were most pronounced, and towards night they were less prominent. As a further evidence of the expansion of concrete under the sun's rays the streets in the City can be named. The footway and carriageway are in asphalte on concrete. The expansion of the concrete in the carriageway presses the curb at the bottom; the expansion of the concrete in the footway presses the curb at the top on the opposite side, and the two have tilted up the curb in a marked manner. The writer has on a hot day taken up asphalte on a footway and has found the heat much greater under the asphalte than on the surface. In order to avoid the expansion showing itself in footways the concrete should be laid in sections, and the joints between them filled with some compressible substance.



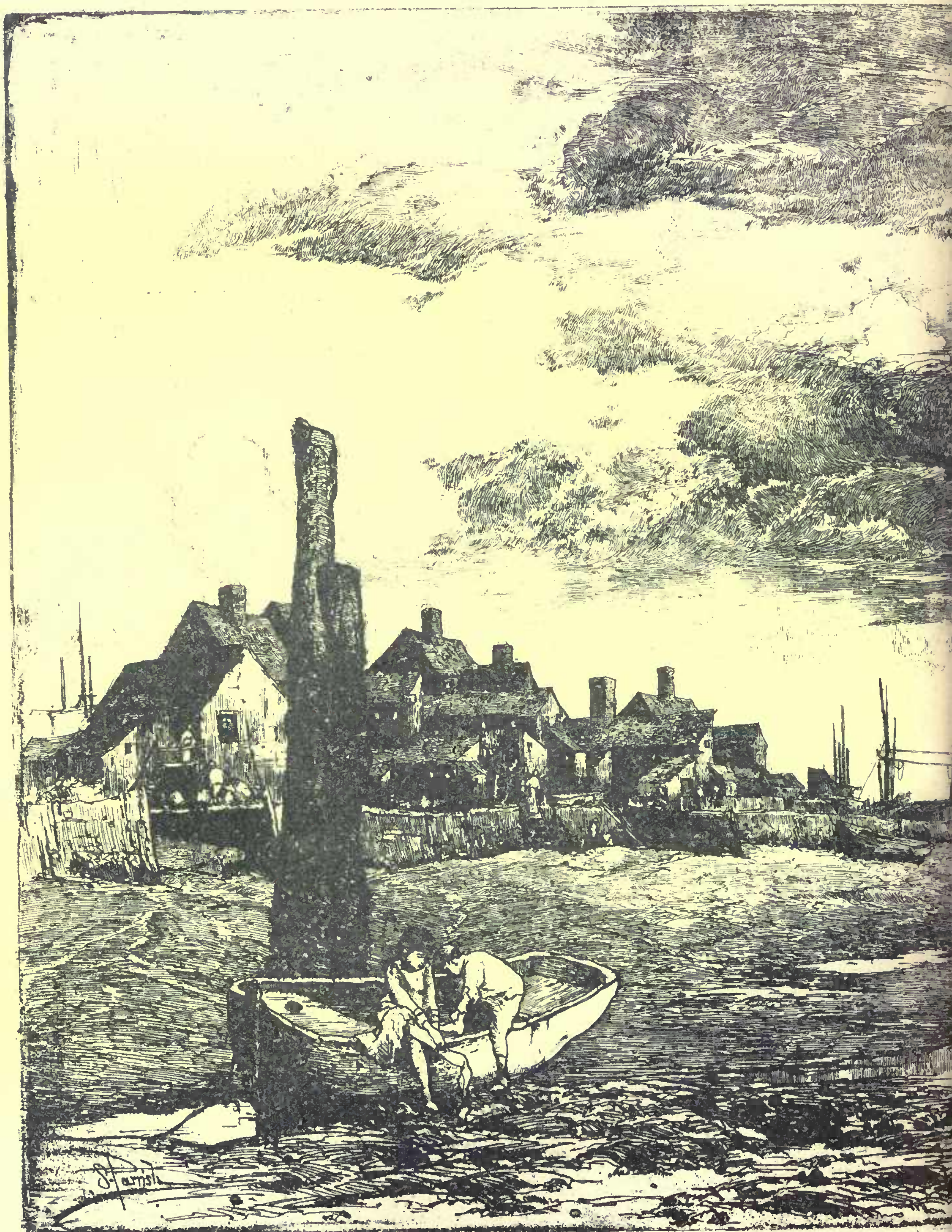
STAIRCASE ROUEN FROM THE MONITEUR DES ARCHITECTES

Compressed asphalte has about one-third longer life than mastic asphalte under the same conditions. The cost is the same, but the use of compressed asphalte for this purpose has not been universally followed by reason of the cracks that appear on its surface. The cracks do not tend to spread under traffic, nor does the asphalte wear more at these parts than at others. They are unsightly, however. It is found that these cracks are exactly of the shape and in the position of the cracks in the concrete foundation. Compressed asphalte has no elasticity in itself, and when subjected to the contracting force of the concrete it is torn through. It is an admirable tell-tale of the movements of the concrete. Much ingenuity has been displayed in endeavors to avoid the cracks. The first step was to localize them. This was done by laying the concrete in 12 feet bays and in alternate bays, and filling up the screed space with fine concrete. The contraction then showed its effects at these places, with the result that a series of regular straight cracks appeared instead of the irregular tree-like cracks when the concrete was laid in one piece. These effects can be seen at many places in London, without specifying any particular place. Having localized the cracks, an experiment was made at Hornsey to avoid them. A strip of bituminous felt 6 inches in width and ¾ inches thick was placed on the concrete over the whole length of the screed mark. This felt has much elasticity, and the object of the experiment was to ascertain whether it would take up the contracting movement of the concrete and absorb it. The length is laid at Crouch Hall road, between Coolhurst road and Clifton road. The result has been that, instead of one crack at each screed mark, there are two, one on each side of the narrow strip of felt. It is evident that the concrete in contracting compresses the asphalte longitudinally, and that the cracks appear at the points where the opposing motions meet; and as the strip of felt represented a narrow area which was free from these forces, a crack appeared on each side where the forces took effect. In Archway road, Hornsey, another experiment was made by covering the screed mark with a strip of mastic asphalte 9 inches in width and ⅛ inch thick, just as in the last case with felt. For three months no cracks appeared; then a few, slowly and at irregular intervals, showed themselves; but during the severe winter of 1886-7 every screed mark showed its crack. These cracks were irregular in line, but they are confined in each case to the area covered by the mastic asphalte. These footways are laid on a 3-inch foundation of concrete. In Marlborough road, Chelsea, an experiment was made on different lines. A foundation of concrete 6 inches thick was laid, and the compressed asphalte laid on it. For four months no cracks appeared, but after that time they occurred at frequent intervals, though they are fewer than usually appear on a 3-inch foundation. When the asphalte and concrete were removed at the cracks it was found that the crack extended through the whole thickness of the concrete. This experiment was based on the observation that cracks do not appear in compressed asphalte carriageways, and as the principal difference between the foundation in the footways and carriageways is the thickness of the concrete, it was assumed that it was the cause. The observation is, however, an incomplete one. In streets of light traffic the cracks do appear in the asphalte, as in Little Blenheim street, Chelsea, and elsewhere. In streets of heavy traffic the cracks in the concrete tear the asphalte as they slowly form, but the traffic welds the asphalte together again before they show on the surface. In footways of heavy traffic there are fewer cracks than in those of light traffic, for a similar reason. At Muswell Hill, Hornsey, the experiment of covering the whole of the area of the footway between Onslow Rise and Grosvenor Gardens with bituminous felt was tried. The felt was in 3-foot widths, and was laid longitudinally with butt joints. At a circular curb the pieces were necessarily somewhat patched. The result



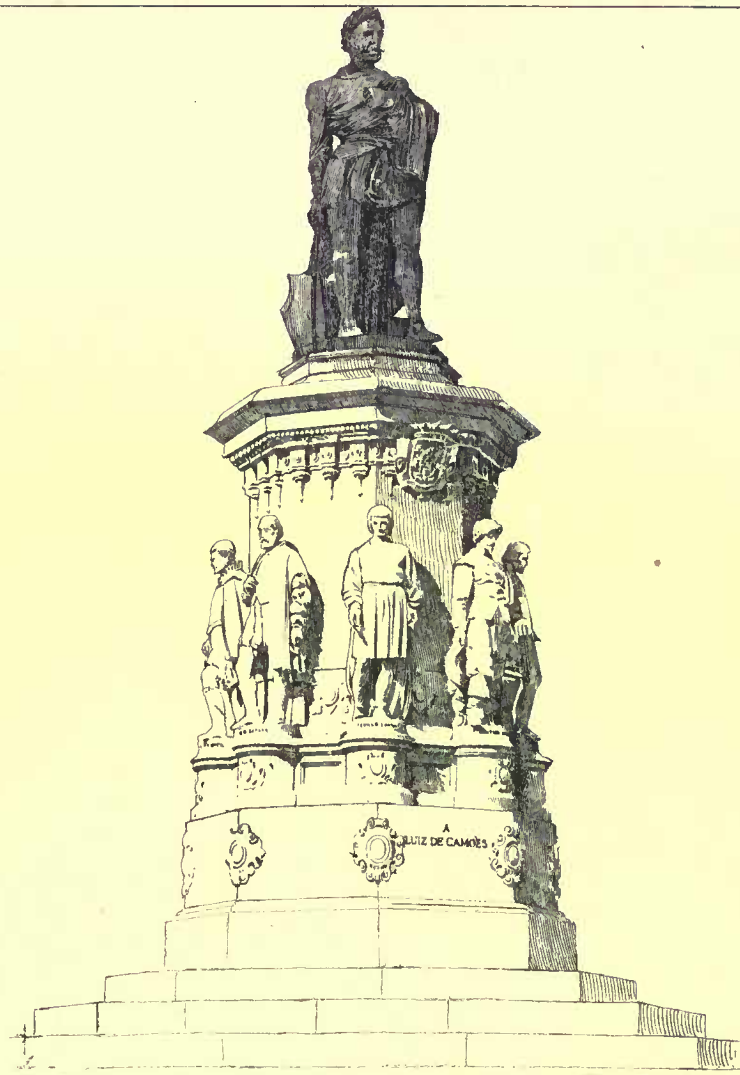
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Chateau, St. Germain-en-Laye, France





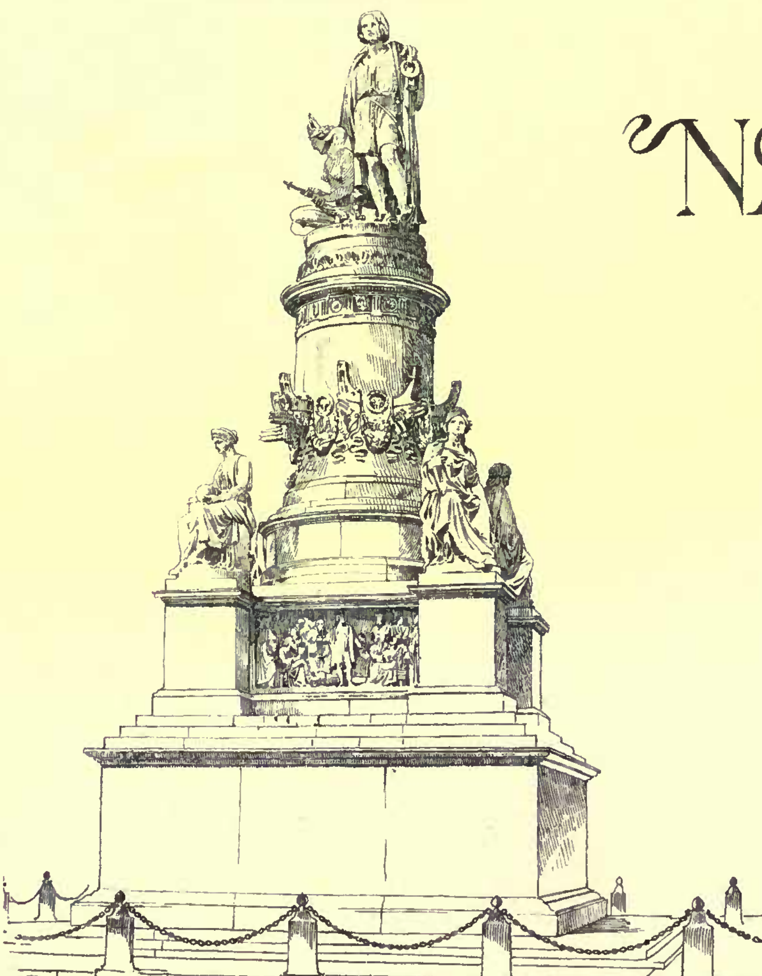
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Statue of Luiz de Camoès: Lisbon. Portugal.
Victor Bastos Sc.r


Statue of Vo
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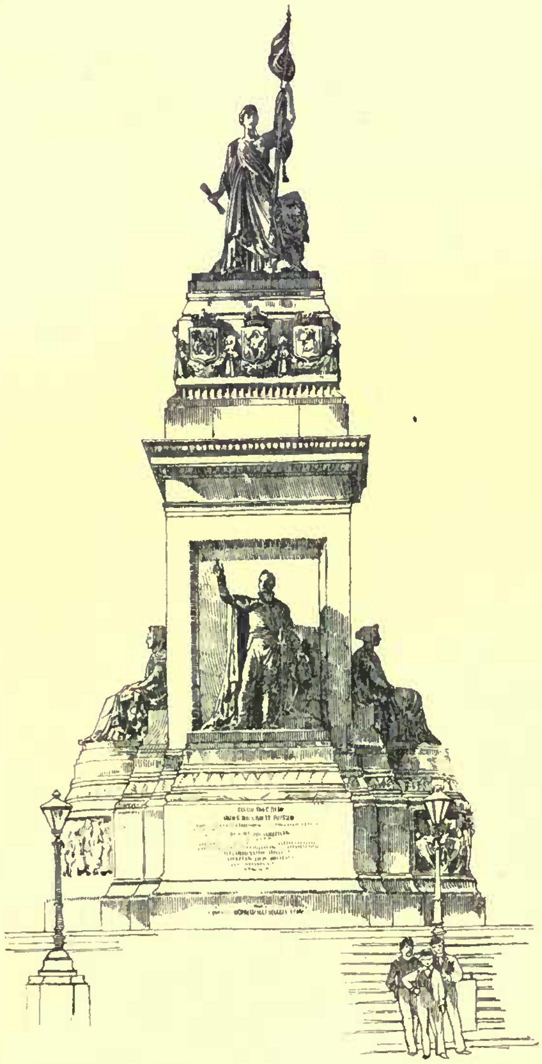

Statue of Christopher Columbus. Genoa.



"Statue of Admiral



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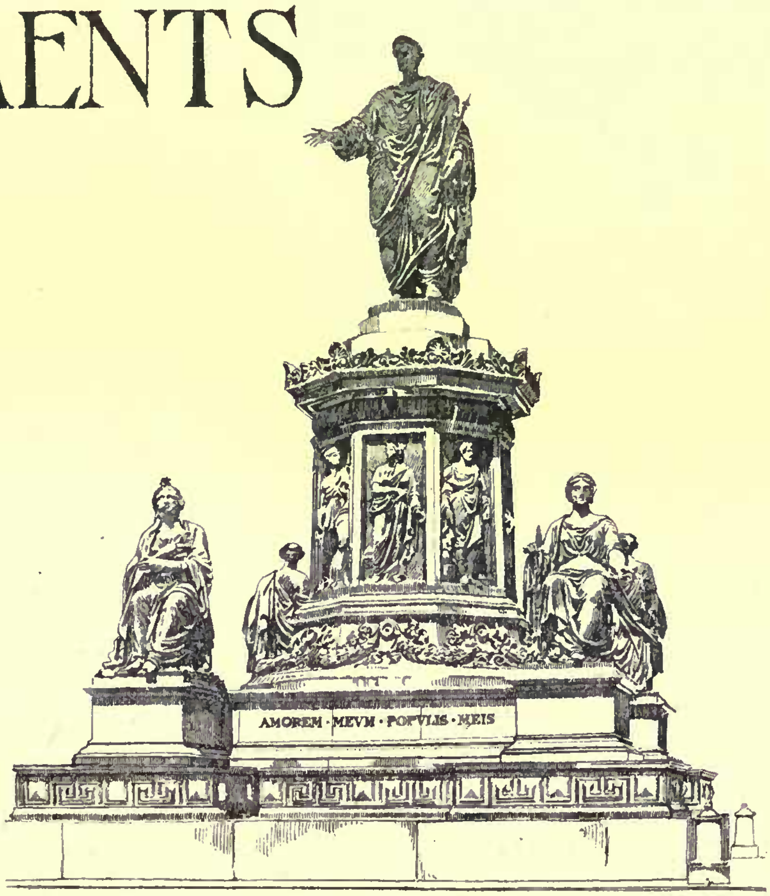


National Monument at the Hague.
W. C. van der Pieterszen. Sc.

MONVMENTS



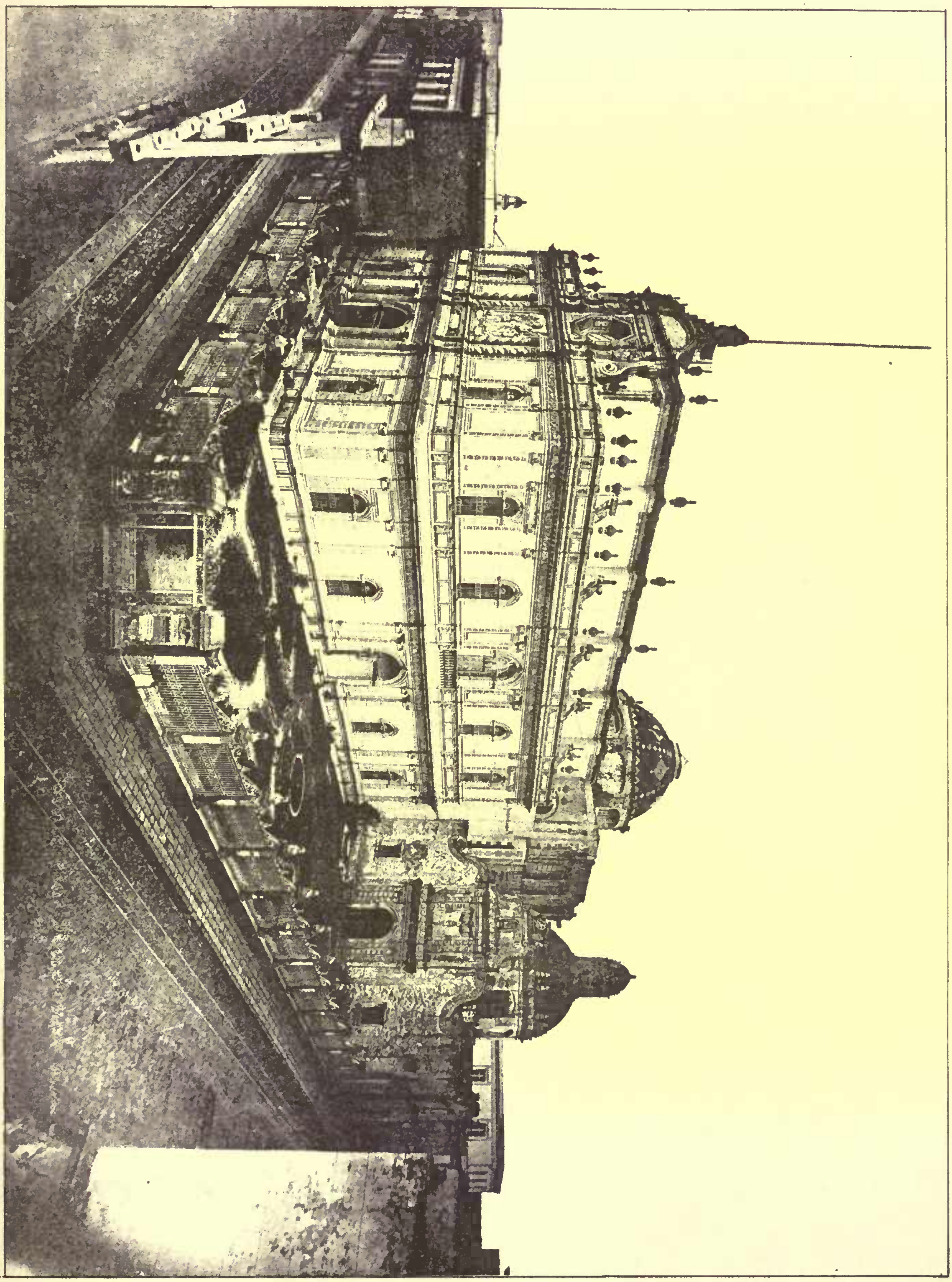




...thoff: Vienna

Statue of Francis 1st Schonbrun

Heliotype Printing Co Boston.



has been that cracks have appeared at every joint of the felt with marvellous fidelity, owing to the movement of the concrete. In Whitehead's Grove, Chelsea, between Marlborough road and Keppel street on the north side, a length was laid in 1885 on a 3-inch concrete foundation, which was covered with mastic asphalte ¼ inch in thickness. On this, ¾ inch of compressed asphalte is laid. The mastic asphalte was laid to absorb by its elasticity the movement of the concrete without transmitting it to the compressed asphalte. It has survived two winters of great severity, and has lived twenty-one months without any cracks appearing. From this it would appear that the principle of a material between the concrete and the compressed asphalte which will absorb the effects of the movements of the concrete is a correct one, and the writer invites the members of the Association to experiment on cheapening the method. The present result is an increase of life of 33 per cent at an increase of cost of 12 per cent.

As evidence of the durability of compressed asphalte in footways, those in Cheapside may be named. They were laid in 1876 at a thickness of 1 inch, and are now wearing through. On the south side of the Strand, east of Wellington street, 1 inch of compressed asphalte was laid in 1881, and has had only the most trifling repairs. The streets in the City, with the heaviest foot traffic in the world, are paved with compressed asphalte on the footways.

The advantages of asphalte foot-pavements are durability, a smooth surface unbroken with joints, a good foothold, even and regular wear, their impervious character, and the readiness and neatness with which they are repaired. They have a sombre appearance, and show water on their surface longer than stone pavements. They wear to the last thickness without breaking up, and give a useful wear for the whole of their thickness. When a stone or other pavement has worn 1 inch it may not be half worn through, but its useful life is over. Where there are cellars under footways, asphalte as a material for footways is unrivalled. In ordinary traffic, such as those named in King's road (7000 to 8000 persons per day), an asphalte pavement 1 inch thick can be laid with the certainty that for at least ten years it will need no repairs whatever. This pavement has also the advantage that the foundation is always preserved and good for use again when the wearing surface of asphalte has to be renewed.

The following abstract of the present contract schedule in Chelsea will give the prices for these pavements: —

	℔ sq. yd. s.	d.
Compressed or mastic asphalte 1″ in thickness on 3″ of concrete	6	3
" " ¾″ thick	5	6
Compress'd asphalte ¾″ thick, on ¼″ of mastic asphalte, laid on 3″ of concrete	7	0
" on mastic asphalte 1″ thick on existing concrete foundation (relay)	3	6
" on mastic asphalte ¾″ thick	3	0

These prices carry a guaranty of free maintenance for ten years. The Vestry prepares the foundation for the concrete in new work at a cost of 2d. per square yard. The specification provides that the asphalte will be cut open at distances not exceeding 50 feet apart, and the thickness measured. Five out of every six of these measurements must be at least the specified thickness, and the average of every six must be at least the specified thickness. The specification is strictly adhered to. The cost of the foot-pavement in New Bond street, already referred to, over twenty-six years, would be as follows at per square yard: —

	s.	d.
Preparing foundation	0	2
Laying concrete foundation and ¾″ mastic asphalte	5	6
At end of 13 years relaying mastic asphalte (life 13 years)	3	0
Repairs	0	0
Total	8	8

or a cost per year, not including interest, of 4d. per square yard. It should be mentioned that the small cost of renewing asphalte footways is due to the fact that the asphalte taken up is as good as new asphalte after it has been cleaned and prepared, and is re-used for footways.

In dealing with the question of concrete as a material for foot-pavements, the writer cannot claim such an experience of it as he has had with asphalte. In 1880, however, the Vestry of Chelsea had laid by the respective makers a series of pavements in King's road against the Royal Military Asylum wall, and in 1885 a report was made on them by the writer.

Mr. Strachan went on to give a synopsis of this report, which is now out of print. In it he described the manufacture of the "Imperial Stone" pavements, of which a specimen piece was laid down in competition with other pavements in King's road, Chelsea. As to these trials of pavements, Mr. Strachan continued: —

In the King's road experimental pavements the makers laid their pavements with the knowledge that they were competing with their rivals. They were laid in 1880. Asphalte, York stone, Ferrumite stone, Victoria stone, and Imperial stone were laid side by side and subjected to the same traffic. The writer includes the York stone results, though not strictly coming within the subject of the paper.

In June, 1884, the Ferrumite stone was removed, as its slipperiness had become a source of danger. Its area was taken by Wilkinson's granite concrete pavement and by Sharp-stone pavement. After five years' wear of the original stones, the following results were obtained: —

The York stone occupied an area of 87 square yards; the original thickness was 3 inches; the number of stones 123, of which, after five years' wear, 10 had broken edges, 16 had broken corners, 21 had their surfaces peeling off, and six were worn so as to be dangerous. The wear was not measurable, by reason of the uneven thickness of the stones, but it was unmistakable. The foothold was good in all weathers. The actual cost was 8s. 7d. per square yard laid.

The Victoria stone occupied an area of 81½ square yards; the original thickness was 2 inches; the number of stones 168, of which thirty-five had broken edges and corners, two had their surfaces peeling off, and three were visibly cracked across. The wear was not quite ⅛ inch at the greatest traffic line. The joints of the stone were pleasing, and the color cheerful. The foothold is not so sure as that of York stone in dry weather, and in a drizzling rain it approaches slipperiness. The cost was 6s. 4d. per square yard laid.

The Imperial stone occupied an area of 90¼ square yards. The original thickness was a full 2⅛ inch; the number of stones, 187, of which eighteen had their corners and edges broken, and one had its surface partly peeled off. The wear was not quite ⅛ inch at the greatest traffic line. The regularity of the joints is pleasing to the eye, and the color is light and cheerful. The foothold is more sure than that of the Victoria stone sample, but it becomes somewhat slippery in drizzling rain. The cost was 6s. per square yard laid.

The experience gained with the Sharp-stone laid in 1884 is more limited, but the stone does not appear to be better than the concrete stones described. The length laid *in situ* by Messrs. Wilkinson is subject to the same remark, but the aggregate is already wearing up. It is laid in 8-foot bays. A repair made in it is a great blemish to it. The effect of the traffic in wear is visible.

Mr. Walker, of Leeds, has laid down (1886) in King's road, a short length, in bays of about 4 feet square. It has a very smooth surface, and appears to be a very good pavement. He lays a foundation of ballast concrete, 2½ inches thick, to within ½ inch of the finished surface, and cuts roughly through it so as to form the bays. He then floats the surface with fine rich concrete, made of one part of cement to one or one and a quarter part of crushed granite or slag which pass through a $\frac{1}{16}$ sieve. This is then cut through with a knife into bays of small areas. The foothold is fairly secure, and the wear very satisfactory. No cracks appear when the bays are made less than 10 feet square. At 322 Oxford Street, a piece has been down three years, and no wear is visible. He claims that his fine rich concrete on the surface attains more nearly to the texture of York stone than any other pavement. The joints, however, have a tendency to spread.

Concrete pavements laid in slabs have two serious disadvantages. The writer's experience refers to Victoria stone, but there is no reason to suppose that slabs of other make are free from them. The first is the annoyance caused by the hard metallic sound of the footfall on them, which is especially noticeable at night. The other is their brittle nature, and the presence of hidden cracks after wear. When taken up to relay, it is often found that a stone which was apparently sound, breaks before it can be relaid.

Concrete pavements *in situ* have the serious disadvantage that they cannot readily and cheaply be repaired. A patch in them shows for the whole life of the pavement, unless a whole bay is removed.

The writer is of opinion that concrete pavements *in situ* are preferable to concrete pavements laid as slabs. There is, however, no reason why this pavement should not be laid by surveyors themselves, without the aid of a contractor. Much has to be learned before concrete as a material for foot pavements is perfected, but that can most readily be learned by each engineer doing his own work, and exchanging experiences. The prices paid for concrete pavements are very great. One stone is advertised for 7d. per square foot, which equals 4l. 14s. 6d. a cubic yard. This is an extravagant price to pay for concrete, even if it be of the very best kind, and silicated too. Concrete for foot pavements has its own field, and within well-marked limits its use is advisable, but until its capabilities are more largely tried, and its usefulness increased, the full advantage will not be obtained from it. The price stated is large enough to cover the cost of experimenting, and the writer trusts that the members will carry out such a series of tests and trials as will complete the knowledge of concrete as a material for foot pavements.

THE ILLUSTRATIONS

[*Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.*]

CHATEAU, ST. GERMAIN DE LIVET, NORMANDY, FRANCE.

[Gelatine Print, issued only with the Imperial and Gelatine Editions.]

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FOR description see article elsewhere in this issue.

NATIONAL MONUMENTS. — III. — THE NATIONAL MONUMENT AT THE HAGUE, HOLLAND, DESIGNED BY W. C. VAN DER PIETERSZEN; MONUMENT TO VOLTA, COMO, ITALY. P. MARCHESI, SCULPTOR; MONUMENT TO ADMIRAL TEGETTHOFF, VIENNA, AUSTRIA, CARL KUNDMANN, SCULPTOR; MONUMENT TO COLUMBUS, GENOA, ITALY; MONUMENT TO FRANCIS I, SCHÖNBRUNN, AUSTRIA. P. MARCHESI, SCULPTOR; MONUMENT TO CAMOENS, LISBON, PORTUGAL. VICTOR BASTOS, SCULPTOR.

THE National Monument at The Hague (1863–9) commemorates the restoration of Dutch independence in 1813, and the return of William Frederick, Prince of Orange, here represented in his coronation robes upon one side of the pedestal. The crowning figure is Batavia; the seated figures upon either side represent Law and Liberty.

The Monument to Volta is national in the sense that he conferred honor not only on his birthplace but upon the whole kingdom.

The Monument to Admiral Tegetthoff is closely allied in intention and spirit to that which is at some time to commemorate Gen. Grant.

The Monument to Columbus was erected in 1862 and is entirely of marble. The seated figures represent Religion, Geography, Strength and Wisdom; the nude figure at the feet of Columbus is America; the bas-reliefs represent scenes from the life of the discoverer.

The Monument to Luiz de Camoes (Camoens) does honor to the author of the great Portuguese epic, the *Lusiad*.

THE BAY OF FUNDY. AFTER AN ETCHING BY MR. SAMUEL PARRISH, PHILADELPHIA, PA.

CHATEAU, ST. GERMAIN-EN-LAYE, FRANCE.

BUILDING MATERIALS.[1] — II.



A Design by Fragonard
From la Revue des Arts Decoratifs

THIS rusting or combination of iron with oxygen results from the exposure of iron to the combined action of air, moisture and carbonic acid. That moisture plays an important part in the oxidation of iron is proved by the fact that a piece of steel is rapidly corroded when exposed to the influence of a mixture of moist oxygen and carbonic acid, whilst but little, if any, effect is produced upon it by the dry gases. The influence exerted by the presence of carbonic acid is probably due to the tendency it would have to induce the formation of a carbonate of the protoxide of iron or ferrous-carbonate, which is subsequently converted into a hydrated-peroxide. It is well known that the tendency of two substances to combine with each other is increased by the presence of a third substance, which exhibits a powerful attraction for the compound resulting from their union. We have a familiar example of such action in the formation of saltpetre (potassium-nitrate), which takes place under favorable circumstances in soils containing potash and nitrogenous organic matter, the union of the nitrogen with the oxygen of the air to form nitric acid being promoted by the presence of a powerful base, such as potash, for which the acid has a strong affinity.

The advantages derived from the use of lime in agriculture are to some extent due to a similar cause, the beneficial effects resulting from the application of lime being most evident when it is applied to newly broken-up ground or soils containing a large quantity of vegetable matter, the decomposition of which is promoted by the presence of lime inducing the formation of organic acids with which it combines. The well-known protective influence which lime or any caustic alkali exerts in preserving iron from rust is to be attributed in a great measure to the absorption of carbonic acid. The coils of fine iron wire used in deep sea-soundings (any rusting of which would be of serious consequence) must necessarily, for obvious reasons, be put away whilst they are wet, and therefore under the most favorable conditions for rusting, but they are preserved by being stored in a solution of caustic soda. Lime is also very commonly employed for preserving articles made of iron. It is well known that when iron has once begun to rust its corrosion proceeds with increased rapidity. This may be due partly to the porosity of the oxide of iron formed, which causes it to absorb moist air more rapidly, but principally to the galvanic action arising from the porous oxide acting the part of an electro-negative element, and the metallic iron that of an electro-positive element, whilst the moisture absorbed performs the functions of the exciting liquid in the cell of a galvanic-battery. Hence we see that in order to preserve iron from being destroyed by rust, it is essential that every particle of rust should be removed as soon as it is formed, and that the smoother, brighter and more polished the surface of the iron can be maintained, the better will it be able to bear exposure to oxidizing influences.

Besides the serious effects produced by oxidation upon iron structures, which, of later years, have grown to such vast importance, the products resulting from the oxidation of iron possess a special interest in connection with the subject of stone, inasmuch as the oxides and other combinations of iron form the chief coloring matter of all rocks. In some cases, such as flints, which become white when calcined, the coloring matter is of a carbonaceous character; in other cases, the color may be due to manganese, chromium, copper, as well as other metals, but the presence of these is rare, as compared with the oxides and other compounds of iron which are almost always present, giving rise to a variety of colors, including black, blue, gray, green, as well as every shade from light yellow to a deep red. The hard kidney-shaped nodules which are found in the red hæmatite ore of Cumberland consist of pure anhydrous peroxide of iron, whilst the brown ores, such as those of Northamptonshire, consist of the hydrated oxide, and in the well-known magnetic iron ore of Sweden, we have the black oxide.

Black oxide of iron is produced when steam is passed over iron at a red heat, the vapor of water being, under these conditions, decomposed, the oxygen combining with the iron to form the black or magnetic oxide, and the hydrogen being evolved as gas. This reaction has been utilized as a means of obtaining hydrogen gas on a considerable scale for filling balloons, and also for producing a coating upon iron which will protect it from further oxidation. This method of preserving iron from rust was made the subject of a patent some years ago by the late Professor Barff, and the process has been successfully carried out with respect to articles that are capable of being subjected to a high temperature without injury.

The iron to be preserved, which must be clean and free from rust, is placed in a chamber which is heated to a temperature of from 1,000° to 1,200° Fahr. Steam is generated in a boiler under a pressure of about thirty pounds to the square inch, and superheated by passing through a series of wrought-iron pipes protected from the effects of the fire over which they are placed, by others of cast-iron. When the chamber is filled with the articles to be operated upon (which may consist of either wrought or cast iron), the door is closed and the temperature maintained chiefly by the steam admitted for a period of from three to five hours.

Another method of preserving iron from rust by means of a coating of this unalterable black oxide, has been patented by Mr. George Bower, which consists in passing the hot gases produced by the combustion of fuel over the iron, instead of steam, mixed with a proportion of air, which is increased or diminished according to whether an oxidizing or reducing effect is desired to be produced. If the iron be rusty, a reducing flame converts the red oxide into the black or magnetic oxide. In the case of wrought-iron that is not rusty, Mr. Bower prefers to produce in the first instance a little red oxide by increasing the quantity of air, as he finds that the black oxide finally produced is rendered thereby less liable to scale off.

Barff's process is best adapted for polished steel or wrought-iron; Bower's for cast-iron and rusty iron. The two processes are now combined, and frequently articles are subjected first to the heated gases produced by combustion and finished by superheated steam.

There can be no question as to the success of the process as regards the smaller description of iron goods, for when properly conducted, iron will bear exposure to the atmosphere under the most trying conditions without a particle of rust being produced, and if specks of rust should make their appearance on spots that may not have been thoroughly coated with the black oxide, the rust shows no tendency to spread. This process is specially adapted for intricate castings, as the gas penetrates the finest lines, producing a thoroughly protective coating. As a means of preparing articles for gilding, it has been of great assistance in overcoming the difficulty previously experienced in coating iron so as to prevent it from rusting, and as a necessary consequence throwing off the gilding. The unavoidable expense incurred in heating large masses of metal to the required temperature renders it difficult to apply a process of this kind to heavy castings, neither is it suitable for protecting wire, because the coating being of a brittle character, breaks off when the wire is bent, unless the coating is too thin to afford efficient protection to the wire. There is a difficulty in applying it successfully to nuts and

[1] A lecture by W. Y. Dent, F.C.S., F.I.C., read before the Society of Arts, and published in the *Journal* of the Society. Continued from page 88, No. 608.

screws on account of the oxide filling up the threads to such an extent as to prevent their working satisfactorily, neither can it be considered a suitable process for chains, the links of which, by friction against each other, soon rub off the coating of black oxide. The necessity of raising the iron to a red heat is also a bar to the use of this process in many cases in which otherwise it would be invaluable as a preventative of rust. The process ordinarily adopted for preserving iron from rust, termed "galvanizing," consists in immersing the iron in a bath of melted zinc, and thus covering the iron with a coating of zinc which rapidly oxidizes on the surface, but under ordinary circumstances the oxide formed remains firmly attached to the metal, and thus protects it from further corrosion. It has lately been proposed to deposit the zinc electrically upon the iron, a process which is said to be successfully carried out at a less cost than the ordinary galvanzing process.

The effects produced by carbonic acid are most strikingly exhibited in its solvent powers as regards the carbonate of lime, carbonate of magnesia and protoxide of iron. Many natural waters contain ferrous-carbonate in solution, more especially those known as chalybeate waters, and from such water, when exposed to the air, peroxide of iron is deposited by the oxidation of the ferrous-carbonate. The hard waters obtained from the chalk contain lime held in solution by carbonic acid, and the softening of such water by what is known as Clark's process, consists in adding just sufficient lime to neutralize the carbonic acid that holds the carbonate of lime in solution, when the whole of the lime existing as carbonate is precipitated, the water being softened down to about one-third of its original hardness, an immense advantage in water required for domestic purposes. It is the solvent action of carbonic acid upon carbonate of lime that gives rise to those magnificent incrustations that occur in the caverns of limestone rocks, such as are found at Clapham Cave in the north of Yorkshire, Castleton in Derbyshire and the Kitcraft Quarry in the Isle of Portland. These incrustations frequently take the form of icicles hanging from the roof, when they are known as stalactites, which are sometimes several feet in length. The pillar-like masses rising from the floor are termed stalagmites. These incrustations are produced by the rain-water, which, charged with carbonic acid, percolates the limestone beds, and dissolves in its progress the carbonate of lime. When the water saturated with carbonate of lime reaches the roof of a cavern and becomes exposed to the air, it loses some of its carbonic acid, and a particle of carbonate of lime is deposited, and when the drop reaches the floor, a further deposit of carbonate of lime takes place, owing to the escape of carbonic acid until, after the lapse of time, large masses of these deposits are accumulated. A very remarkable example of the formation of incrustations of this description during a comparatively short period of time, was discovered when widening the north bridge at Edinburgh connecting the old town with the new. Between the arches of the bridge and the roadway were a number of chambers or vaults varying in height, and from eight feet to ten feet in breadth, which had not been opened since the building of the bridge one hundred years before. From the vaulted-ceilings of these chambers (especially from the joints of the masonry) hung hundreds of delicate sparry crystals of snowy whiteness; many of these reached the floor, forming slender, thread-like pillars resembling a grove of brittle canes, some of these pillars being as much as six feet in length. A large number of little stalagmitic mounds, each surmounted by a short, slender stalk, were also observed, which were evidently the lower ends of what once had been continuous pillars. The bridge was built of sandstone, and this curious formation had been produced by water, which had trickled through the masonry, and had thus become saturated with carbonate of lime from the mortar in the joints.

The solubility of carbonate of lime in water charged with carbonic acid not only gives rise to these very remarkable and curious incrustations, but exerts a very considerable influence upon geological limestone formations, the insoluble carbonate of lime being deposited as a sedimentary rock. The white concretionary limestone, known as travertin, of which both ancient and modern Rome are largely built, is an example of such a deposit which is taking place in some parts of Tuscany at the rate of six inches a year. Carbonate of lime being deposited from its solution in carbonic acid, serves to bind together other materials with which it comes in contact in the course of such deposition; it thus serves as the binding material of several varities of building stone, and becomes an important agent in the formation of rocks. An excellent example of such formation is to be seen at Bermuda. The islands are surrounded by immense beds of calcareous sand, to the extent of twenty miles, resulting from the disintegration and breaking up of the coral-reefs which abound in that part of the world. This sand is washed up by the sea, caught by the prevailing winds, and blown up into hills forty feet or fifty feet in height; the rain falling upon these calcareous deposits dissolves out from the upper portions carbonate of lime, which is again deposited as the water percolates the drift, and binds together the particles of sand, as well as other *débris* into a coherent mass which gradually hardens into a rock.

Under normal conditions of the atmosphere, the agents which tend to alter and decompose whatever is subjected to their influence, are few in number and comparatively slow in their action; deriving the enormous power they exert from the persistency of such action through long periods of time; but this can hardly be said to be the case as regards the atmosphere of our large towns, and especially of those in which extensive manufacturing operations of various kinds are carried on. The air of such towns becomes charged with substances of a much more deleterious and corrosive character than those which I have described as belonging to the atmosphere in its normal condition. In the neighborhood of alkali works, potteries and other manufactories where large quantities of common salt are decomposed, the air is liable to contain appreciable quantities of hydrochloric acid, although the amount of this highly corrosive mineral-acid that is now allowed to escape into the air is very much less than was formerly the case before the Alkali Act was passed, which enforces the condensation of all acid-fumes as far as practicable. The sulphuric acid, either in a free or combined state, existing in the air of towns, is of more serious consequence than the hydrochloric, not only on account of its existing in much larger quantities, but because it is derived, in a great measure, from the sulphur contained in the coal burnt for domestic as well as other ordinary purposes, so that no extension of the Alkali Act could relieve us from this impurity. The total consumption of coal in all large towns is enormous, and when we consider that the greater part of this coal contains from a half to two per cent of sulphur, we must see what a vast quantity of sulphuric acid is likely to be produced from this source. Taking the average quantity of sulphur in coal as amounting to one per cent, we have one ton, or 2,240 pounds, yielding twenty-two pounds of sulphur, which, by absorption of oxygen, is capable of producing sixty-seven pounds of oil of vitriol. The late Dr. Angus Smith, who for several years carried out a long series of investigations on the impurities existing in the air of large towns, found the air in some parts of Manchester to contain as much as from 800 to 1,200 grains of sulphuric acid (either in a free or combined state) in every 1,000,000 cubic feet, and from 100 to 150 grains of hydrochloric acid either as such, or as chlorides. The presence of this large amount of acid matter existing in the air was corroborated by the quantity found in rain-water; the mean result of a vast number of experiments, conducted through a whole year, gave an average of from three to four grains of these acids, either in a free or combined state, in an imperial gallon. In parts of London where coal is consumed chiefly for domestic purposes, 730 grains of sulphuric acid, either as such or in combination, was found in 1,000,000 cubic-feet of air. To whatever extent these acids may be neutralized by combination with the ammonia, or other alkaline matter with which they came in contact, there can be no question but that the sulphuric acid (either in a free or combined state) existing in the air of towns is very detrimental to many descriptions of stone, and altogether precludes the use of such a material as Caen stone for the exterior of buildings which are so situated as to be liable to be exposed to its influence. On examining the crumbling surface of Caen stone from buildings in large towns, it has been found that the decayed portions of this stone contain a considerable quantity of sulphate of lime. Dr. Angus Smith found mortar in Manchester in which the lime had been to a large extent converted into sulphate, and on examining the black deposit which collects in the hollow spaces between the stones on the walls of St. Paul's Cathedral, I found it to consist of particles of sand and other *débris* (which no doubt had greatly assisted in producing abrasion of the surface of the stone), soot, together with a very large quantity of sulphate of lime. When this crust remains firmly attached to the stone the policy of removing it may be questionable, as it probably serves to protect the surface of the stone from further action.

The amount of acidity acquired by rain in large manufacturing towns is sufficient to cause it to act rapidly upon galvanized-iron roofs unless protected by paint. The zinc oxide which under ordinary circumstances remains attached to the metal is readily attacked by weak acids, and if subjected to the action of acid rain, the zinc coating is rapidly destroyed, and the surface of the iron is exposed.

It has been proposed to use iron covered with lead for corrugated roofs, which are subjected to the influence of a smoky atmosphere as being less easily attacked than the zinc. In galvanizing, the iron simply requires to be immersed in a bath of melted zinc, but lead will not attach itself to iron under similar stated circumstances. This difficulty is stated, however, to be overcome by mixing with the lead small quantities of phosphorus and arsenic. This method of coating iron was made the subject of a patent in America, and in England, three years ago. Having considered the nature of the influences to which stone is liable to be exposed which tend to promote its destruction, let us now turn our attention to the chemical composition and physical structure of the various descriptions of stone used for building purposes, and their relative capability of resisting exposure to such influences as have been described. Of these a block of hard and compact well-polished granite is unquestionably one of the most durable. To be hewn out of the solid rock has in every age been regarded as typical of endurance, and the word granite is so associated in our minds with all that is lasting and permanent, that to speak of any building as being constructed of granite is considered to be a guaranty of its strength and durability. The term granite is understood by geologists to indicate a rock consisting of quartz, felspar and mica in a crystalline granular condition, which may be associated to a greater or less extent with other minerals, such as hornblende, talc, schorl, etc., which give rise to a number of rocks differing in their composition and character, and distinguished from each other by various names, derived either from that of the prevailing constituent or from the localities in which they were first known. Thus we have talcose granite, in which the quartz, felspar

and mica are associated with talc; hornblende, or syenite-granite, in which the mica is more or less replaced by hornblende. The word syenite, derived from Syene in Egypt, whence was first obtained the beautiful material so largely used by the Egytians for obelisks and other architectural purposes, has been hitherto understood to represent a granite in which the mica has been replaced by hornblende, but this term is now restricted by geologists to a rock consisting of a crystalline granular mixture of orthoclase and hornblende.

Of the three constituents of typical granite, quartz offers the greatest resistance to any weathering action. When it exists in the form of hard colorless crystals (commonly known as rock crystal) it is pure silica. The crystals, however, frequently assume various shades of color, according to which they have received appropriate names, such as rose quartz, milk quartz, the amber-colored crystals being known as cairngorm stones, from having been found in the Cairngorm Mountains of Aberdeenshire. Silica in this highly crystalline condition resists the action of almost every chemical reagent with the exception of hydrofluoric acid, but it can be made to combine with an alkali by the assistance of heat. Felspar, as represented by the mineral orthoclase, consists of silica, alumina and potash, and of silica, alumina and soda, as represented by the lighter colored mineral albite. Lime also enters into the composition of some felspars, such as oligoclase, which contains two per cent of lime, and labradorite, which contains from ten to twelve per cent, this last being an opalescent felspar, exhibiting a peculiar iridescent display of colors when the light falls upon it in certain directions.

Mica, so named from its being easily divided into glistening scales, consists of silica and alumina, associated with magnesia, soda and lime, in varying proportions; thus we have potash mica, consisting of silica, alumina and potash; and magnesia mica, in which the alumina is partially replaced by magnesia, passing (as the proportion of magnesia increases) into soft talc, which is chiefly composed of silica and magnesia.

The term granite, as commonly employed, is used in a much more comprehensive sense than belongs to it legitimately, as understood by geologists, for under this general term are included many hard crystalline rocks which differ in their composition from true granite; the so-called granites of Leicestershire, Guernsey and Jersey, as well as that of the Malvern Hills, partaking more or less of the character of syenite.

The several descriptions of granite differ materially from each other, both as regards their composition and physical structure; whilst those which are well crystallized are extremely durable, there are some granite deposits which possess but little cohesion, and readily yield to the influence of atmospheric changes. In several districts examples of granite of this latter description are to be found, but there are none so remarkable as those which exist in Cornwall, where some of these granitic deposits are in such a friable condition that a slight blow is sufficient to make the mass fall to pieces, forming the deposit known by the name of china-stone, whilst in other parts, the decomposition of the felspar of the granite has proceeded to such an extent that the deposits have become converted into china-clay or kaolin, so named from two Chinese words signifying a high ridge. The natural china-clay contains crystals of quartz and flakes of mica, with sometimes a little schorl and undecomposed felspar; it is covered by a layer of sand, stones and impure discolored clay, varying from thirty to forty feet in thickness, which it is necessary to remove before the clay can be worked. The broken up clay is exposed to the action of a stream of water, which, carrying off the finer portions in suspension, is led through long channels (in which the sand and rougher particles are deposited) into large pits from thirty to forty feet in diameter, and from seven to ten feet in depth, in which a further deposit of the heavier particles takes place; it is finally conducted into tanks in which the fine clay held in suspension by the water is allowed to deposit, the effluent water being sometimes collected in reservoirs to be used over again. The clay, which is of the consistency of soft mud, is removed from the tanks to the drying-floors, which are formed of fire-clay tiles heated by flues. It is spread upon these floors to a thickness of from six to nine inches, and when dry constitutes the kaolin or china-clay of commerce, as supplied for the manufacture of porcelain, and other purposes. This china-clay is prepared on an extensive scale, the larger works turning out as much as from 3,000 to 8,000 tons per annum. The first china or " hard " porcelain (by which is meant a porcelain capable of bearing a high temperature without fusion) made in Europe was that manufactured at Plymouth by Mr. Cookworthy, who discovered this clay at St. Stephen's, in Cornwall, in 1755. The clay is largely used as a dressing for calico, by paper-makers to give body and weight to their goods, and in the manufacture of ultramarine blue. Extensive deposits of this clay exist in China, America, in the north of France and in the Island of Bornholm, which supplies the clay required by Sweden, Denmark and the north of Germany.

The constituent of granite that is generally the first to undergo decomposition is the felspar, although there are cases in which the felspar stands out in sharp well-defined crystals, exhibiting quite as little tendency to decay as the other portions of the rock. In decomposing, the crystals lose their lustre, and as the disintegration proceeds, the potash and soda are washed away as soluble salts (for the most part as carbonates), leaving a hydrated silicate of alumina constituting the kaolin that remains. Experiments have been made which show that under favorable circumstances carbonic acid exerts an appreciable amount of action upon a variety of minerals, such as hornblende, serpentine, or apatite, and that this action is augmented by increased pressure.

With respect to the origin of the enormous deposits of crumbling granite, such as those found in Devonshire and Cornwall (covering as they do a large area of ground, and having in some places a depth of more than 100 feet), no very satisfactory explanation can be given. The clay in some cases rests upon granite of the hardest description, and it is the opinion of the best authorities that these deposits have either never been properly consolidated, or that they are the results of surface-decomposition which have been swept by the action of water into the spots which they now occupy.

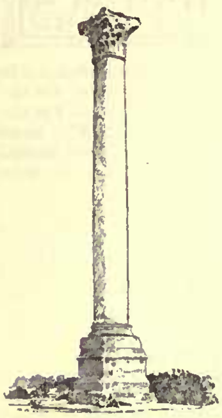
In selecting stone for building purposes, too much attention cannot be paid to its physical structure, inasmuch as whatever may be its composition, stone which is of a hard, dense, crystalline character is not only capable of resisting more effectually the action of erosive agents when in actual contact with them, but is not exposed to the same amount of contact as is the case with stone of a more porous character, for when rain falls upon a close, polished surface it cannot sink into the stone, and consequently any matter of a corrosive nature with which it may be charged does not remain in contact with the stone for any length of time, but is carried off before it has had an opportunity of exercising an injurious effect. It is obvious that the more crystalline and compact is the character of the stone, the more capable it is likely to be of resisting the effects ordinarily produced by exposure to atmospheric influences, whether such may be of a normal description, or whether they may be of a more powerfully corrosive nature. It is to its physical structure alone that marble (which consists of carbonate of lime) owes its durability; its highly crystalline character rendering it sometimes capable of being favorably compared with granite, as is the case in some of the churches of Devonshire erected from 400 to 500 years ago, in which the marble shows fewer signs of alteration than the granite.

The importance of crystalline structure, as affecting the durability of stone, appears to have been recognized from a very remote period. Whoever the constructors of the great pyramid may have been, and whatever purpose they had in view in carrying on a work involving such an enormous amount of labor, it is quite certain that they must have been proficients in the art of building in stone. They appear to have exhibited much skill in its selection, and were acquainted with the best methods of dealing with large blocks, fully appreciating the advantages to be derived from fitting such blocks as closely together as possible with very thin joints. The celebrated red porphyry of Egypt, which derived its name from its purple color, was hard enough to be capable of taking a fine polish, and was largely used by the Egyptians, and subsequently by the Romans, for statuary purposes. It was upon a circular slab of this material, now at St. Peter's at Rome, that the Roman emperors were crowned. Columns of porphyry, after the lapse of 1,900 years, still exist which retain their freshness of color. The term porphyry is now applied to any rock having distinct crystals embedded in a felspathic matrix, and is used to designate the crystalline character of a rock. We have thus quartz porphyry, porphyritic granite, porphyritic greenstone. Cornwall is especially rich in these porphyritic rocks, a very excellent material, capable of taking a high polish, being obtained from the neighborhood of Bodmin. It was a schorlaceous variety of this description which is found on the surface in immense boulders near Luxullian, and hence known as luxulliante, that was selected for the sarcophagus of the late Duke of Wellington in St. Paul's Cathedral. The very perfect condition in which works of art of such great antiquity as those of Egypt have been found, is no doubt mainly due to the dryness of the climate of Egypt, but still, in part, to the excellent quality of the material employed. The syenite granite of Egypt was extensively worked as far back as 1,300 years B. C., the quarries whence it was obtained occupying an extensive tract of land between the first cataract of the Nile and the town of Assouan, which now stands near the site of the ancient Syene.

The famous Egyptian obelisks, one of which, known as Cleopatra's Needle, originally erected at Heliopolis (the "On" mentioned in the book of Genesis) about 1800 B. C., and now standing on the Thames Embankment, were obtained from these quarries. The obelisk at Rome was also one of those that stood in front of the Temple of the Sun, where it is said to have remained for 2,000 years before it was removed to Rome by Cæsar Augustus after the battle of Actium.

It is somewhat remarkable that the neighborhood of this ancient Syene, which for thousands of years had been the frontier town dividing Egypt from Nubia, should now in this nineteenth century be the site of explorations which are creating so much interest. On examining the sandstone hill on the west bank of the Nile, the removal of the sand led to the discovery, in 1885–1886, of a series of tombs where the nobles and chiefs of ancient Syene had been buried, containing inscriptions which indicate that the hill had been used as a cemetery as far back as 3000 B. C. From these inscriptions much interesting information is to be gathered of the manners and customs prevailing at the remote period to which they allude, some of them being of great historical interest. The freshness of the paintings on some of the shrines is surprising, and the colors are wonderfully true to nature. The hieroglyphs for granite hills are good representation of granite, and that of an elephant is painted in a grayish sepia the exact color of the animal.

THE EXCAVATIONS AT SICYON.



Pompey's Pillar.

MR. W. J. McMURTRY sends to the New York *Evening Post* the following description of the discoveries at Sicyon: Many of your readers are aware that, during the past spring, excavations upon the site of the ancient Greek city of Sicyon have been carried on under the auspices of the American School of Classical Studies at Athens. As a student of the school, and one who had immediate charge of this work, I send you a brief account of these excavations, believing that it will be of interest to all friends of Greek learning and archæology.

Sicyon is the second classical site upon which the American School has made excavations. Its selection was justified by its importance, especially in the history of Greek art, and by the fact that no systematic excavations had ever been made there. It was situated a few miles westward of Corinth, about two miles from the Corinthian Gulf. Writers on Greek history and geography become enthusiastic in describing the situation and surroundings of the city. It lay upon a large, level plateau, at the foot of which a plain of great fertility extends down to the blue, sparkling waters of the gulf. Across this rise the peaks of Helicon and Parnassus. On the east the plain is bounded by the bold mass of Acrocorinthus. The landscape is exceedingly beautiful; and Curtius and other writers are, no doubt, right in supposing that to the exceptional charm of its natural surroundings must be attributed a part of the influences which make Sicyon so famous a home of the arts.

Numerous ruins still exist upon the site, consisting of the theatre, the stadium, considerable remains of a large brick structure (probably Roman baths), many foundations of buildings, aqueducts cut in the rock, and traces of streets. There are extensive remains of the wall surrounding the acropolis, which was constructed by Dematrius Poliorcetes. Fragments of the columns also are found in and about the churches of the modern village of Vasiliká. It was thought best to confine our work mainly to the theatre. Our chief object was to discover its complete plan; but at the same time we propose to do some digging on the foundations of other buildings, since we desired to identify, if possible, some ot these structures with the temples or other buildings mentioned by Pausanias in his account of the city, and hoped also to find some artistic remains. But we accomplished little of importance outside of the theatre, finding no inscriptions, and only a piece of marble upon which were the toes of a statue, and an Ionic capital of ordinary stone. The results of our work in connection with the theatre, however, are of great archæological value. It was one of the largest in Greece; the plan of its structure can now, for the first time, be studied. Dr. Dörpfeld, the distinguished architect of the German Institute at Athens, who has suggested new theories on the structure of Greek theatres, has shown the greatest interest in the results of its excavation.

The plateau upon which Sicyon lay is separated by a rocky declivity into two portions, a larger one nearer the gulf and a smaller one in the rear. The theatre was cut out of this rocky declivity. When we began our excavations there were to be seen slight traces of the stage, foundations of the stone seats, and two large arches, one on each side of the cavea, leading from the outside to the higher rows of seats. Over the orchestra was a layer of earth from three to nine feet deep. I will very briefly describe what may be seen now. There are three main walls belonging to the stage foundations. The one nearest the orchestra is about seventy-two feet long and three feet high. At its foot, in front, an ornamental marble border extends nearly its entire length. The blocks composing this border have at the ends the masons' marks, in the form of Greek letters. Upon one of them is one of the inscriptions that we found. This front wall has three doors in it, the middle one being double. It is evidently of Roman construction, being composed of not very large blocks of stone, and having bricks built into it. The second wall is of a different character from the first. It is made of large blocks of stone, well laid, and is, without doubt, of Greek construction. Its length is about forty-eight feet; its height the same as that of the first wall. It has in it only one door. The third wall is of mixed construction, part being like the first one and part like the second. It has the same length and height as the second wall. In it are two doors. At the distance of about twenty-one feet from the east end of the stage, a cross-wall extends between the second and third walls at right angles to them.

To determine the form of the orchestra, we dug a trench, which laid bare its boundary. It has an elliptical form; but the ellipse is not a complete one. Along half the circumference of the orchestra we dug far enough upward from the orchestra-boundary to lay bare five rows of seats. There are fourteen stairways extending upward from the orchestra, dividing the seats into fifteen divisions, or *kerkides*, as the Greeks called them. The seats are cut out of the rock. The front row is of more elaborate construction than the rest, each seat having a back and arms. These better seats, however, are not of marble, but of the same ordinary stone as the others. Probably priests and other dignitaries sat in these seats, as in the marble chairs of the Dionysiac Theatre at Athens.

The drainage system of the theatre seems to have been elaborate. A deep drain extends around the orchestra to the entrances, having stone bridges opposite the stairways, precisely as in the theatre at Athens. An aqueduct passes from the centre of the orchestra to the stage, and out under the middle door of the first wall. Another extends from the western side of the orchestra to the one just mentioned. In various places earthen pipes were found, which evidently served as drains.

I have already mentioned two arches, which afforded entrance and exit to the people in the higher rows of seats. These arches are interesting, as adding another to the very rare examples of Hellenic arches. The old theory that the Greeks did not construct arches until after they came under Roman influence must be abandoned. Another arch of Hellenic construction was found by the Germans at Olympia. That the arches at Sicyon are not Roman is manifest from their construction. There is in them no trace of mortar or brick. In the dimensions of the blocks and the manner of laying them, the arches are exactly like the portions of the stage walls that must be attributed to the Greeks.

In addition to the three main walls of the stage-structure we found two others in the rear running parallel to them. Both these walls seem to be of Roman construction. A portion of a column, apparently *in situ*, upon the outer wall would seem to indicate that it was the foundation-wall of a colonnade adorning the front of the theatre.

In following up the wall last mentioned we found a structure, the nature of which is obscure, though it seems to have been a fountain of somewhat elaborate construction. In front are portions of four columns, still in position. These columns are channelled only upon the outer side. Back of the columns, at a distance of about three feet, is a semi-circular enclosure, with plastered walls and a smooth floor. A semi-circular mass projects in front of the rear wall. A great number of fragments of tiles found within would seem to indicate that the structure was roofed. Both in the front wall, forming the diameter of the semicircle, and in the rear curved wall, are orifices, apparently for the passage of water. On the west side is a well-constructed trough having a back like a seat. This trough was probably for the use of horses. At this fountain, also, earthen water-pipes were found. Here our last digging was done. Some traces of other foundations appeared, and further digging at this point would probably not be fruitless.

The artistic remains which we found are not of very great value. The most important are: The arm of a statue of more than life-size; a piece of the leg of another statue; the lower part of a draped statue. These were found in the earth covering the stage. We found numerous architectural fragments, among others an Ionic epistyle of common stone, a Doric epistyle of marble, pieces of Ionic and Doric capitals, and of lion-headed water-spouts. Some fragments bore traces of blue and red paint. We found numerous copper coins having upon them the dove, the well-known symbol of Sicyon. We found also a number of small earthen lamps. We discovered only two inscriptions, one of the Roman period, incomplete, relating to honors to be bestowed upon certain ambassadors; the other of the Alexandrian period, recording the victories gained in various games by one Callistratos, the son of Philothales.

A detailed report of the work done at Sicyon, accompanied by a plan of the theatre, and illustrations, will appear in the volume of papers of the American School for the present year.

SOCIETIES

THE ANNUAL CONVENTION A. I. A.

THE following information concerning the annual convention of the American Institute of Architects has just reached us from the official sources:

IN BOARD OF TRUSTEES, A. I. A., June 15, 1887.

"The question of arrangements for the next annual convention of the Institute being in order, the Secretary and Mr. Littell, of the Board of Trustees, and Messrs. Jenney and Gay, of Chicago, were appointed a Committee of Arrangements therefor, and it was resolved that, in accordance with the invitation received last year, through M. Root, President of the W. A. A., the said convention should be held in Chicago, at a date, preferably in October, to be fixed by said committee."

August 10, 1887.

—— Esq. *President* }
—— " *Secretary* } —— Chapter A. I. A.

Dear Sir, — Referring to the approaching Twenty-first Convention of the A. I. A., to be held in Chicago, permit me to call your attention to the enclosed copy of circular letter, and to ask you to fill in the blank and let me know the name of some member of your Chapter who would be likely to respond with a paper on the kind of structure chosen for treatment.

I would also suggest that another member of your Chapter be selected to prepare some condensed "suggestions towards the best and speediest methods for harmonizing and utilizing all the architectural societies in the United States, so as to secure the most good for

architecture, for the public, and for the profession in America — due regard being had, as concerns means, alike to individual energy and enthusiasm, and to associative experience; and, as concerns ends, alike to local sentiment, and to national reputation."

And if you think it compatible with the interprofessional relations and other conditions of your locality, I beg, moreover, to suggest that still another member might be selected to prepare a brief résumé of the high-class architectural work lately executed in your neighborhood. Or, if preferred, the secretary of your Chapter might embody this in his annual report to the Institute.

As the make-up of the programme will depend on the information received in regard to the above-mentioned points, an early answer is particularly requested. Yours respectfully, A. J. Bloor, *Sec'y.*

For Messrs. W. L. B. Jenney, E. T. Littell, H. L. Gay and myself, Committee of Arrangements Twenty-first Convention A. I. A.

August 10, 1887.

Dear Sirs, — Desiring to make the approaching Twenty-first Convention of the Institute an interesting one, I beg to ask you to prepare, if at all consistent with your engagements, a short paper on "The paramount requirements of a large [blank to be filled in with generic name of structure], as regards site, construction, disposition of space, arrangements for water-supply, day and night illumination, ingress and exit, heating, ventilation, hygiene generally, and provision against conflagration; as well as any other points involved in this special theme which your studies and experience have lead you to class as important."

As style is generally conceded to be a matter of taste, chiefly dependent on education or temperament, environment or fashion, or on a combination of these. I have not included it under paramount requirements; but it is, nevertheless, the crowning element of an edifice in its relations with the contemporary public (outside of its occupants and habitués), and with posterity and history; and, if you think it best to enter such a wide field of your subject, the Convention will doubtless be very glad to hear what a fellow-specialist of your prominence may desire to say on it.

The paper should be as brief as possible, to allow time for the reading of other papers, and for the discussion of all, as well as for the usual large amount of routine work. It need not be delivered to the Secretary before October 1st ensuing, but, if you accept the obligation I have the honor to propose to you, a speedy answer is requested, as the programme of the Convention must be published shortly.

Yours respectfully, A. J. Bloor, *Secretary.*

COMMUNICATIONS

CEMENT-STUCCO WORK.

To the Editors of the American Architect: —

Dear Sirs, — I have done some work in cement-stucco over rough brick wall, which proves very unsatisfactory in color, being mottled, etc. I cannot paint it, because the cement would eat through the paint. Can you suggest any treatment that will produce an even, uniform and permanent tone of color?

Respectfully yours, A. B. Jennings.

[If the character of the work admits, perhaps the safest way would be to cover the stucco-surface with rough-cast of lime and gravel, which may be colored with ochre, Venetian-red, or other mineral colors; or the stucco may be treated with acid. — Eds. American Architect.]

MORE BRIBERY,

Boston, August 15, 1887.

To the Editors of the American Architect: —

Dear Sirs, — The following "complimentary" communication is now being sent to architects by the well-known firm whose name it bears:

Compliments of
Joel Goldthwait & Co.
We are now showing our European Specialties for the Fall Season.

Special inducements offered for your influence in placing these goods with your clients. Personal interviews solicited.

The compliment, no doubt, is contained in the frank assumption of the final clause that the influence of architects may be secured by "special inducements," the nature of which may be more clearly stated during the "personal interviews" which are solicited.

Yours, with respect, Horace G. Wadlin.

[As Messrs. Joel Goldthwait & Co. have thought it not best to give any answer to a polite note we addressed to them asking for information as to the "special inducements" they offer to architects, there is obviously no other inference to be drawn than that they know they are doing something of which they have reason to be ashamed. As the firm is given by the commercial agencies a large capital and the highest credit, it would seem as if it might content itself with gathering wealth in legitimate ways without descending to the use of bribery and corruption. The incident exhibits clearly how wide is the difference between the "highest commercial integrity" and what those outside of business circles understand by uprightness and honorable action. — Eds. American Architect.]

NOTES AND CLIPPINGS

A Bronze Buffalo Head. — The largest bronze casting ever made in America — a buffalo head, designed by Kemeys, the sculptor, for the stone arch which constitutes the east portal of the new Union Pacific bridge across the Missouri at Omaha — was cast last week. The head measures 9 by 5 feet, and the box containing the sand and plaster mould was 22 × 22 × 26 feet. Some 4,500 pounds of molten bronze were poured into it. — *Engineering News.*

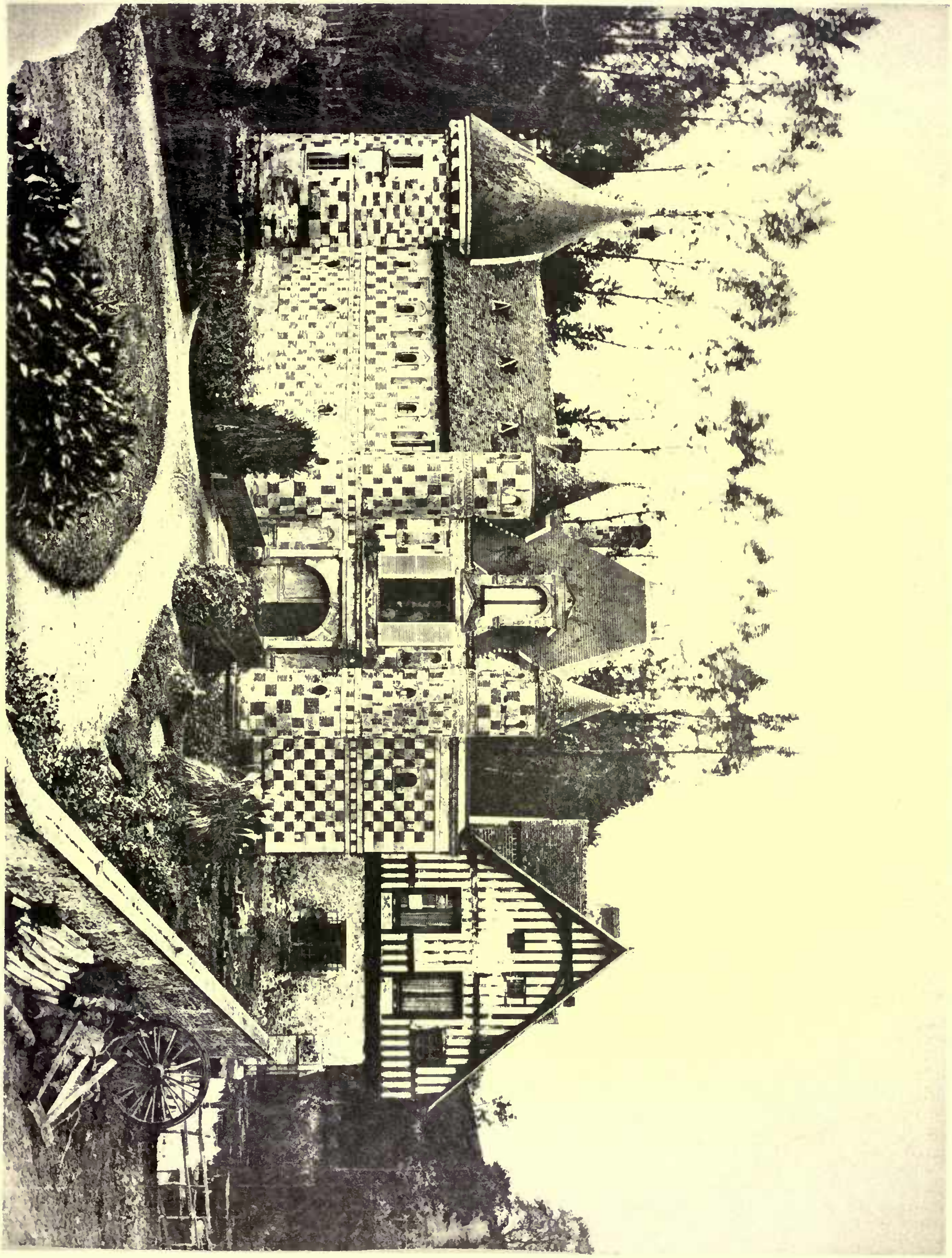
Providence Sewage System. — The plan proposed by Mr. Samuel M. Gray for the disposal of the Providence, R. I., sewage, and the purification of the waters bordering on the city, has been formally adopted by the City Council. This means the impounding of the sewage at Fields's Point, 14 feet below city datum, there to be lifted 28 feet by pumps, then chemically treated, and the effluent discharged into the river. Thus Providence, like Boston, takes a radical step in the direction of its sewage-disposal, and sets an example to other American cities which are in like manner troubled, but still remain content with make-shifts rather than grasp the subject in the intelligent and satisfactory manner that has characterized the work of Mr. Gray and his associates at Providence. — *Engineering News.*

The Exhibition of 1879. — The works on the Champ de Mars for the Exhibition of 1889 are going on apace. The foundations for several of the large buildings have been laid, and the modern Tower of Babel, which is being constructed under the auspices of M. Eiffel, is gradually rising from the ground. M. Eiffel hopes that it will be quite finished by October next year. The first story, about 180 feet in height, will, in all probability, be completed at the end of December, and we shall then be able to form a fair conception of the character of the entire structure. Curiously enough, the workmen engaged in clearing the centre of the Champ de Mars have met with unexpected difficulties, owing to the fact that portions of the old exhibition buildings had not been properly removed. They have been obliged to have recourse to blasting. I hear, by the way, that most of the men, about 600 in number are employed at the rate of 2½*d.* to 3*d.* per hour. These are low wages for Paris, but the behavior of the laborers has been excellent, and their zeal and activity have already won for them no small amount of commendation. — *London Daily Telegraph.*

TRADE SURVEYS

A false alarm has been raised in financial circles relative to the sufficiency of money for business requirements. Less money is seeking speculative channels, and more is finding its way into legitimate channels. The business interests owe less money than ever for the volume of business done. Railroad companies and builders in many lines are heavy borrowers, but the rate of interest is low, long-time loans are made, the properties concerned are likely to be productive at an early date, and will enjoy a large business. In short, the foundations are strong, and it will be impossible to create much alarm among the men who are broadening tho industries and commerce of the country. A very moderate percentage of railroad capital has fallen into receiver's or sheriff's hands. Very little of the new mileage is in advance of the time. Railroad-building requirements are still the chief factor in trade, and help more than any other to preserve the steadiness of values. Since July 1st prices for all leading products have remained almost stationary. This is encouraging in view of the expansion of facilities. Since that date no less than a dozen large sea-going vessels have been placed under contract, more than two hundred locomotive-engines, four thousand freight-cars, a large river and lake tonnage, the details of which it is impossible to tabulate, and a vast amount of general business has been done which leaves the industries, from the greatest to the smallest, in better shape than on July 1. The lumber manufacturers are entering on a fall lumber demand with a full stock. Yellow pine is in larger supply at Southern points than a year ago. Cypress and sap are being manufactured in larger quantities. The entire list of hardwoods is strong, and the supply has been materially increased in all Atlantic coast markets. In fact, in one or two cities besides Boston the supply is a little in excess of demand. White pine is also abundant, but the overplus is held in the West under strong control. The sash and door interests complain of low prices. Saw-mill interests apprehend a slight cessation of activity. Makers of wood-working machinery report, in some sections, a slacking of demand, though the larger concerns, like those at Cincinnati, make no complaints as to dulness. The Western manufacturers of foundry products, tools, machine-shop equipments, implements large and small, after a very busy spring and summer are now obliged to run full time to fill orders. The textile interests throughout New England are quite busy at a number of points. Canadian labor is returning from a two to six weeks' stay, and, in consequence, quite a number of looms and wheels are idle. The makers of electrical appliances are especially busy. The manufacturers of American articles for export have extended their markets abroad for many products, and the European and British continental markets are being worked with renewed zeal.

Coming back to the Iron industry, it is found to be in excellent condition. There are no indications of a falling off in demand in any quarter. Taking business in general, the volume is heavy. Bank clearings indicate activity and health. Failures are few. Collections are good. Bad debts amount to but a trifling percentage. New orders are coming in earlier than usual. Travelling agents so far have met with success. The distribution of merchandise over store counters has been good, and the low condition of stocks gives assurance that the autumn trade will be up to all the sanguine anticipations indulged in concerning it. Builders are busy. Permits and new operations increase. Building-material is cheap. Alterations and repairs are absorbing at least double the amount of money expended for such purposes in any former year. The upward tendency in land values seems to have been checked. A vast amount of city property all over this country is being changed from domestic to business purposes, as well as for manufacturing requirements. The progress made is safe and healthful, and the wealth-producers have every reason to feel proud of their conservative management in all directions.



CHATEAU AT ST. GERMAIN DE LIVET, NORMANDY, FRANCE.

HELIOTYPE PRINTING CO. BOSTON

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SEPTEMBER 3, 1887.

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CONTENTS

IN another part of this issue will be found the essential details of a most praiseworthy and fairly successful effort to give becoming expression to the sense of gratitude and good-will that a large number of the younger American architects have always privately entertained towards the French Government, but until now have lacked the means and opportunity to give it proper expression. The generosity of the French Government in throwing open to foreigners its, in many ways, unexcelled technical and art schools has few parallels abroad, and none, we believe, in this country, and it was fully time that Americans, who, in greater numbers than any other nation, take advantage of the opportunities thus offered, should take some step, not to balance the account—that would be indeed difficult — but to give an outward evidence of their deep sense of obligation. Many will be inclined to look on this movement merely as a stroke of policy, an effort to "hedge" against the possibility that the French authorities might see fit to deny to Americans the accustomed privileges in retaliation for the stupid embargo that our own Government has thought fit to impose through its atrocious tariff on works of art. We know, however, that the Prix de Reconnaissance des Architectes Américains is purely what its name declares, an expression — in its present state somewhat inadequate — of gratitude. The feeling for their French comrades that Americans bring away from Paris is a very strong and vital one, and there must be few indeed who have experienced the kindness, the self-sacrificing helpfulness and contagious enthusiasm of the French pupils in a Paris atelier that do not hope at some time to revisit the scenes of their former studies, and do not feel sure that it will be an easy matter to pick up the dropped threads of friendship. The spirit of the French atelier is one of *bonne camaraderie*, and it is in that spirit that the American architects make their gift.

THE *Sanitary Record* tells a story of a tenant's experiences with a badly-drained house, which conveys some valuable suggestions. Unfortunately, the course of judicial decisions of late has been rather in the direction of restricting the right of tenants to compel landlords to keep the plumbing of their houses in good order. It is quite possible that the disposition of dishonest persons to evade payment of their rent by complaining of the drainage may have made it necessary for the courts to make sure that a good case was established before granting relief; but, however this may be, any one who wishes to compel his landlord to offset sewer-gas against rent must now make it plain that the sewer-gas is present in extraordinary quantities. On the whole, the tenants who have taken the law into their own hands seem to fare the best. One family in New York, which immediately moved out of the premises it had taken on a lease, on finding the rooms smelling of drainage, successfully resisted the attempt of the landlord to enforce his lease, and in the *Sanitary Record's* case, a tenant, after in vain asking his landlord to have the plumbing put in order, had it thoroughly done at his own expense, and then claimed the amount from the landlord, who was obliged to pay it with costs. The house was in a very fashionable quarter of London, surrounded by aristocratic mansions, and was represented by its owner to be in excellent sanitary condition, "in fact, the sweetest house in London." The idea of living in such a sanitary paradise seems to have pleased the tenant greatly, but he was still prudent enough to have the inspector for the district examine the house. This official, whose idea of his duties reminds one strongly of those which obtain in some of our cities, reported that the house was "in fair sanitary condition," but advised some trifling changes. The landlord said he would make these changes, assuring his tenant that as long as he lived in the house he should never have any trouble about the drains. Whether he really made the alterations does not appear, but the tenant seems to have put such faith in his assurances as to suppose that he did, and wrote him a note, in which he said that he was "satisfied with everything," and that the work promised had been carried out to his satisfaction. On moving in, however, the tenant found that the "sweetest house in London" was not all that it should be. On the contrary, it was afflicted with vile smells, and he began to have doubts of its salubrity. He called the attention of the landlord to the odors, but could get nothing done to remedy them. Finally, he concluded to call in the aid of that excellent organization, the London and Suburban Sanitary Survey Association, and paid it a fee of some twenty-two dollars for a disinterested examination of the house. The inspector of the Association found that this "sweet" house was furnished with a huge brick drain, leaky, and partially choked with putrescent deposit, into which discharged, from the upper stories, two "filthy, worn-out and defective" water-closets, with traps corroded into holes, while another water-closet of similar description and used by the servants, was connected directly to the drinking-water cistern. The report of these interesting discoveries was sent to the landlord, who, in fact, was present at the inspection, but he only contented himself with loud assertions that the drain was "a beautiful one and in perfect order," while he explained the presence of three or four inches of black sediment in it by saying that the inspector and his men had got coal-dust and sand into it by flushing out the cisterns. The water-closets he admitted to be old-fashioned, but said that they were perfectly good, and insisted that no repairs or alterations were necessary. The tenant then, finding that his landlord would do nothing, moved out of the house, and had a new drain laid, and the rest of the work put in tolerable order, at a cost of something over a hundred dollars, and sent the bill, together with that for the rent of the rooms in which he lived while his house was being put in order, and the inspector's bill, to the landlord. The whole amounted to about a hundred and seventy dollars, and, on the landlord's refusal to pay, he sued him for it. One would think that he ought to have collected the whole amount, but there seem to have been circumstances which inclined the judge to be lenient, and he directed a verdict for the plaintiff for one hundred and twenty-five dollars and costs.

THE *Sanitary News* mentions two cases in which systems of town sewerage have been constructed as private enterprises, to the great advantage of the citizens, and, we hope, to the profit of the projector. Hundreds of towns and villages have been furnished with a pure water-supply in this way, either through the foresight and courage of a single person, as in the case of Newport, which owes a debt to Mr. Norman that cannot easily be repaid, or by the association of a few individuals, as is now very common; and there is no reason whatever, that we can see, why sewerage works should not be built and maintained on the same principle. At Asbury Park, N. J., which may be taken as the best example at present existing, Mr. James A. Bradley has laid at his own expense more than thirteen miles of pipe sewers, on the separate system, varying from eight to twelve inches in diameter. The sewers are properly ventilated, and a rental is charged for house-connections, the rent ranging from ten dollars per year upward. When this admirable work was undertaken, Asbury Park was a village, entirely unable to bear the expense of sewers, but the fact of their construction, by other means, brought the town at once into notice, and attracted population so rapidly that it is

now quite rich enough to build or buy sewers for itself. Nevertheless, although Mr. Bradley has been so liberal as to offer to transfer the property at an appraised valuation, the citizens are so well satisfied with the management of the sewers, and the price they pay for the service, that they show no disposition to acquire possession of them.

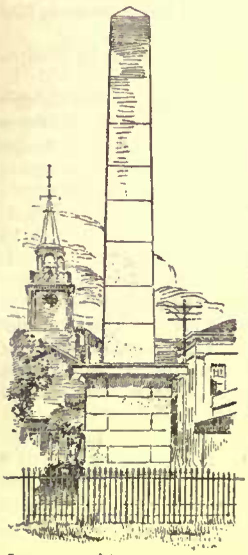
ONE is hardly likely to observe at the first glance all the advantages of such an arrangement. To look at it from the tax-payer's point of view, private ownership of the sewers, with a moderate rental for the use of them, is greatly to be preferred in a small and growing town to the assumption of a heavy burden of public debt. Every one knows that nothing frightens away would-be citizens more effectually from a young town than a large debt. A man who buys an estate in a place with a debt, finds his land already mortgaged, under the law, to pay that debt; and, worse still, he knows, if he is experienced in the ways of assessors, that he will be heavily taxed, false valuations put on property to conceal the exorbitant rate of taxation, and the value of his estate seriously injured as much by the unreliable valuations as by the encumbrance. Of course, the sewers built with the borrowed money render the houses in the town more desirable, and increase their value, but they do very little, if anything, to increase the value of unimproved land, for the reason that the holder of an unimproved estate, who wishes to build upon it, is generally assessed an enormous price for bringing the sewers to his property, in addition to the burden of debt and taxation which his land already shares with the other estates in the town. Moreover, as the main sewers for a town of ten thousand inhabitants are usually made large enough for a future population of twenty thousand, the town of ten thousand people must mortgage its property, and tax its citizens, to carry a load proportioned to a corporate body of twice its size, and those who wish to become inhabitants naturally take alarm at the aspect of the burden which they must help to support. By the commission of the first great outlay to private enterprise all this is changed, and all the advantages of sewerage are secured without the assumption of a public burden. Let any one imagine himself a young man, with a few thousand dollars, looking for a place to make himself a home. At A. he finds a town, like Elizabeth, N. J., and several others in various States, which has brought itself to bankruptcy by borrowing money for public improvements. Taxes have increased until they can no longer be collected, the larger real-estate owners are vainly endeavoring to sell their property at a fraction of its cost; and the bond-holders, under the decision that a town debt constitutes a first mortgage on all the real-estate within its territory, are clamoring at the gates with foreclosure papers. It is hardly necessary to say that he feels no disposition to risk his money here, and passes on to the enterprising village of B. Here the taxes are nominally low, but, if he is shrewd enough to compare the valuations with the rents, or actual sales, are really high: a large water-debt has been assumed, and a small, compact body of men are persistently urging through the town-meetings the creation of another, and much larger debt for the introduction of a sewerage system. No one can tell just what the debt will be, and our prudent young friend makes one more trial. At C. he finds water introduced, and sewers already built, but, on inquiring the cost, and the proportion of the town debt to the valuation, he is told that there is no debt, and that both water-works and the sewers are private property; that, if he buys land and builds, pipes will, if necessary, be extended to his house without cost to him, or assessment on his property, and that he may either dispose of the drainage from his house on his own land, or may have the privilege of discharging it into the sewer for an annual payment of about what it would cost him to pump out a cesspool. It is hardly conceivable that our sensible young man would not hasten to forthwith look out for the best available lot in this fortunate town, and he would find plenty of others there on the same errand. He is considered now a very poor man who cannot, or will not, pay six or eight dollars a year for a supply of water to a single sink, and sewer drainage, independent of its immense advantage in healthfulness, would, at Mr. Bradley's rates, be an actual economy. There is, of course, no reason why the public authority should not charge rent for sewer service, as well as for water-supply, and the interest and the sinking fund for a sewer debt might thus be provided for as effectually as water debts now are; but the combination of surface with house-drainage probably complicates the matter, while public work is notoriously worse done, and worse looked after, at greater cost, than private work of the same kind. Evidently, the charges for sewer privileges, under such circumstances, ought to be large enough to pay good interest on the money invested in the system, to attract capital, which, however, they may easily be without exceeding the annual cost of the filthy cesspool and vault; and as a further inducement to private persons to undertake the work, the public authority would often be of service in securing an outfall by the exercise of the right of eminent domain in behalf of the enterprise, as well, perhaps, as in the enforcement of sanitary regulations made practicable by the provision of sewers. For example, we believe that a town ordinance at Asbury Park now forbids the use of a leaching cesspool within the municipal limits. Of course, the ordinance, although it does not prohibit, as we understand, tight cesspools, or subsoil irrigation, practically urges citizens to make use of the new sewers; but there can be no question that the public authority has the right to do so; and if boards of health are entitled to order wells filled up, as they often do in places with public water-supply, they have much more right to compel the abandonment of cesspools and vaults, which threaten the lives, not only of their owners, but of their neighbors.

A GOOD suggestion is made in the *British Architect* about the new English coinage, which would apply equally well to that of other nations. An attempt has been made to introduce a feebly decimal character into the British currency by reviving the florin, or two-shilling piece, which, it will be observed, is one-tenth of a pound, and new designs have been made for the coin, as well as for the double florin, which is to be issued with it. The designs so far tried are condemned pretty unanimously as ugly, and there has been a good deal of discussion as to the way to go to work to get better ones. One authority proposes a competition, to be confined to the official art schools, while another wishes to have a limited competition among the best sculptors of the day. The *British Architect* improves upon this by proposing to admit decorative artists, as well as sculptors, to the contest; and we hope that this idea will be acted upon. There is no reason why the coinage of a country should not be made not only a credit to its artistic knowledge but an admirable means of educating the taste of the people; yet, with few exceptions, the coins of modern civilized nations are designed with a meagreness of idea, an ugliness of modelling, and an ignorance of the first principles of filling a given space agreeably, for which there is no excuse. Directors of mints, occasionally, when they hear some one laughing at the contrast between a Greek and a modern coin, explain it by saying that our coins would wear too rapidly if they were made with the high relief of the ancient ones; but this is a very poor apology. Some of the small Belgian coins, which are, perhaps, the prettiest of all the modern examples, have a vigorous effect given them, not by raising the effigy in the centre much above the general surface, but by surrounding it with a sunk space, from which it stands out bold and round, although protected from wear by the rim which carries the inscription. With the English or American coins, in which a profile head or other figure swims about in an ocean of background, such a treatment would be impracticable; but the Belgian designers fit their lion very cleverly into his circular frame, without either crowding or awkward vacancies. A disposition of this sort would be the very one which would first occur to a trained decorative artist, to whom the jumbles that now pass muster for coinage designs would be abominations; and a sculptor of the first rank might then be called in with great advantage to complete the modelling.

THE reclamation from the desert, of portions of Northern Africa by means of artesian wells, seems to be going on prosperously. The first well has constantly increased its flow, and now irrigates an area of fifteen hundred acres, on which are growing many thousand palm trees, besides garden crops for the support of the population which has flocked to the place, and a second well has been driven, about two miles from the first, which already delivers nearly twice as much water as the first. If the flow from the second can be distributed as successfully as that from the first, the two wells, neither of which is three hundred feet deep, will bring into cultivation an area of more than seven square miles, forming an oasis of considerable importance, and it seems now probable that the French Government may take measures for restoring their ancient fertility to tracts which were once renowned for their fruitfulness.

EARLY SETTLER MEMORIALS.[1]—XII.

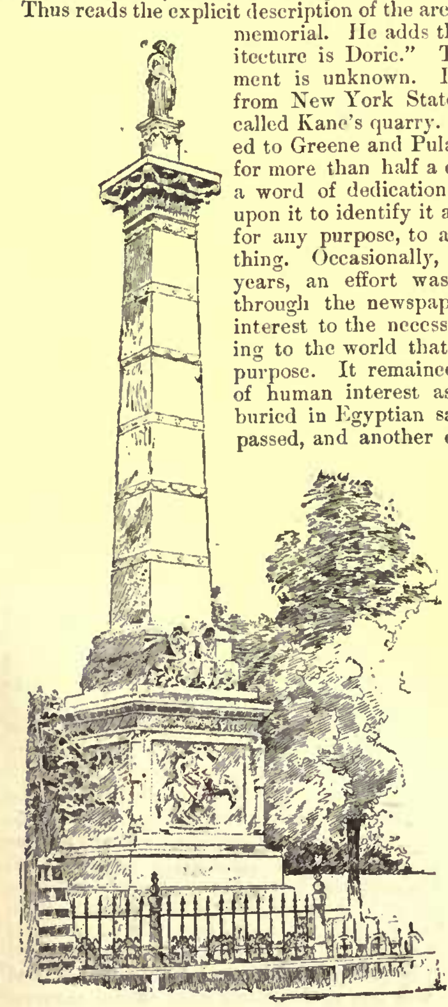
THE GENERAL GREENE MONUMENT.



GREENE MONUMENT
SAVANNAH GA.

DURING the visit of Lafayette to Savannah, Ga., in 1825, he laid the corner-stones of two monuments which it was proposed to erect to the memory of General Nathaniel Greene, and Count Pulaski. One was laid in Johnson, and the other in Chippewa Square; the first for Greene, and the second for Pulaski. In 1826, the commissioners who had the erection of the monuments in charge advertised for designs for the two structures, and offered premiums of not more than $50, each, "for those two which would most exactly combine simplicity with neatness, and economy with durability." As little success was had in collecting funds by private subscription, the Legislature granted authority to raise by lottery the sum of $30,000, to aid in the erection of the monuments. Unable, even in this way to raise a sufficient amount for both, the commissioners decided to erect one monument in memory of the two heroes, and the one in Johnson Square was completed in 1830. The design was furnished by William Strickland, the architect of the old United States Bank, in Philadelphia, and the State Capitol, at Nashville, Tenn. It is described as "an obelisk of white marble, fifty feet high, resting upon a base twenty by eleven feet. Pedestal eight feet five inches, by four feet eight inches, rising thirteen feet, and surmounted by a cornice of one foot. From the pedestal, a needle, composed of only seven pieces, each of which weighs more than eight thousand pounds. The needle is thirty-six feet high, five feet four inches by three feet at base, four feet two inches by three feet at apex."

Thus reads the explicit description of the architect of this "needle" memorial. He adds that "the style of architecture is Doric." The cost of the monument is unknown. It is made of marble from New York State, and from a locality called Kane's quarry. Although it was erected to Greene and Pulaski, and was so known for more than half a century, there was not a word of dedication or inscription placed upon it to identify it as having been erected for any purpose, to any person, or for any thing. Occasionally, during the succeeding years, an effort was made without avail, through the newspapers, to awaken public interest to the necessity of at least indicating to the world that the monument had a purpose. It remained, however, as devoid of human interest as though it had been buried in Egyptian sands. One generation passed, and another came, bringing with it, as a covering to the Kane marble, a tender parti-colored moss, that gave the monument the appearance of some huge tropical vegetable, growing into instead of out of the earth.



Monument to Pulaski, Savannah, Ga. R. E. Launitz, Sculptor.

Meantime, the commissioners had renewed their Greene and Pulaski Monument Lottery charter, and raised $20,000, for a monument to Pulaski. In May, 1852, they chose a plan prepared by Launitz, and contracted with him for its erection for the sum of $17,000. It is fifty-five feet high, and made of Italian marble. Its original site was changed from Chippewa, to Monterey Square, where another corner-stone was laid, with imposing ceremonies, October 11, 1852, the seventy-fourth anniversary of Pulaski's death. The monument was erected in December, 1854. It is thus inscribed:

PULASKI
THE HEROIC POLE
WHO FELL MORTALLY WOUNDED
WHILE FIGHTING FOR AMERICAN LIBERTY
AT THE SEIGE OF SAVANNAH,
9 OCTOBER, 1779.

The description of the monument, as given by Launitz in his letter to the commissioners is as follows: — "In designing this monument I have had particular regard to purity of style, richness of effect, and strength and durability in material and execution, while I have not lost sight of the main object, which is to design a monument for Pulaski.

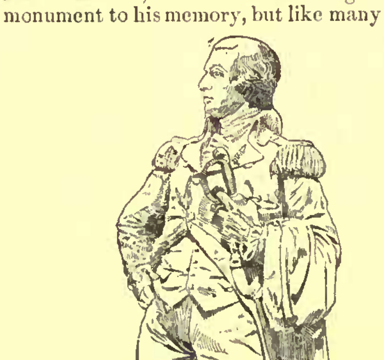
"It is perceived, at the first glance, that the monument is intended for a soldier who is losing his life, fighting. Wounded, he falls from his horse while still grasping his sword. The date of the event is recorded above the subject. The arms of Poland and Georgia, surrounded by branches of laurel, ornament the cornice on both sides, or fronts. They stand united together, while the eagle, emblem of liberty, independence and courage, rests on both, bidding proud defiance. The eagle being the symbolic bird both of Poland and of America, the allegory needs no further explanation. The inverted cannons on the corners of the die are emblematic of military loss and mourning, while they give to the monument a strong military character.

"To facilitate the execution of the shaft, which would be impossible to execute in one piece, I have divided the same into several parts, separated by bands, so as to remove the unsightliness of horizontal joints on a plain surface. The bands are alternately ornamented with stars, emblems of the States and Territories now existing and in embryo, that enjoy, and will enjoy, the fruits of the valor and patriotism of the heroes of the Revolution. The garlands on the alternate bands above the stars, denote that the States are green and flourishing. The shaft is surmounted by a highly elaborate Corinthian cap, which adds richness, loftiness, and grandeur to the structure. The monument is surmounted by a statue of Liberty, embracing with her left arm the banner of the stars and stripes, while in her right hand is extended the laurel wreath. The love of Liberty brought Pulaski to America; for love of Liberty he fought, and for Liberty he lost his life. Thus, I thought that Liberty should crown his monument, and share with him the homage of the free."

THE GREENE STATUE.

Before the close of the War of Independence, and soon after the death of Greene, the Continental Congress passed a resolution to erect a monument to his memory, but like many similar schemes proposed by that ancient body, nothing has ever been done about it. Curiously enough the resolution embraced an inscription that was to be placed upon the future structure. About 1870, the State of Rhode Island, commissioned the late H. K. Brown, sculptor, to execute a marble statue of Greene, to be placed in the Hall of Sculpture in the Capitol at Washington.

In June, 1887, at the suggestion of Mr. Clark, the architect of the Capitol, the Secretary of War caused to be inscribed on the pedestal of the statue the inscription above referred to. It reads as follows:



Gen. N. Greene, Washington, D. C.
H. K. Brown, Sculptor.

"Sacred to the memory of Nathaniel Greene, Esquire, a native of the State of Rhode Island, who died on the 19th of June, 1786, late Major-General in the service of the United States and commander of their army in the Southern Department. The United States, in Congress assembled, in honor of his patriotism, valor and ability, have erected this monument."

Meanwhile, what has become of the man-forgotten but moss-covered object in Savannah? Finding that neither public interest nor patriotism, nor the recommending charms of a lottery could mark Greene's name upon the Doric needle, after more than fifty years of effort, a member of the City Council of Savannah conceived the happy thought that the Georgia Historical Society ought to take the matter in hand and see what they could do. Accordingly, in 1883, a committee from each of these two bodies met together and solemnly discussed the situation, but succeeded in finding no solution of the difficulty. There the "needle" was, proof against the desecrating hand of forgetfulness and ingratitude. To approach it directly was impossible, but a flank movement might succeed. So it was thought that, as the one hundredth anniversary of the Chatham Artillery would be celebrated in May, 1886, it would be a good plan to use that occasion

[1] Continued from page 61, No. 606.

as a motive in awakening interest in the necessity of appropriately inscribing Greene's name upon the monument. The proposition met with public approval, and one thousand dollars were raised to pay for two bronze panels, which were placed upon the monument and unveiled May 6, 1886.

"The one on the south side of the die bears a wretched high-relief portrait of General Greene, accompanied by an orderly and a rearing horse." On the opposite side of the die is this inscription:

"MAJ. GEN. NATHANIEL GREENE,
BORN IN RHODE ISLAND, 1742,
DIED IN GEORGIA, 1786.
This shaft has been raised by the people of Savannah in honor of his great service to the American Revolution.

The panels were made by Gabriel Turini, of New York.

We know of no American patriot of the Revolution who has been treated with as much contumely as General Greene, so far as monument and statue memorials are concerned. Many of his military comrades have no memorials, and few know where their ashes repose. It is better that it should be so, because, next to honored remembrance in art, is seclusion from caricature, as illustrated in the objects set up to the memory of General Greene. As a final instance of the indifference with which the Greene monument was regarded by the city of Savannah it should be mentioned that when, in 1829, the commissioners asked the City Council for permission to enclose the square, in which it stands, with an iron fence, their petition was granted "upon condition that it be done without cost to the city."

It would be interesting to know why the memory of Pulaski was uppermost in the hearts and pockets of the people of Savannah, in 1852, while that of Greene awakened no response.

It is a pity, though perhaps not surprising, that the Pulaski monument cannot be taken as a starting-point of future progress, by the people of Savannah, in the art of monument-building. It is probably the finest example of its author's skill and taste, and certainly one of the very best public monuments existing in the United States. As an architectural effect, the Washington column at Baltimore, is superior. The Pulaski represents the best skill the country possessed at the time of its erection, and it was made without reference to the cost of time or money. Not a single public monument of which we have any knowledge, has since been erected that represents anything like the skill existing in the country. It was a common remark of Launitz that the majority of his best monuments, of all descriptions, were made for the South, and it is the most natural thing in the world to suppose that the effect of these works would have been in the direction of progress, in the refinement of taste and sensibility, if such a thing were possible, and if not, the next thing to it, a hesitancy to erect anything less meritorious. But it appears that the South, like the North, has gone backwards in this matter, and that material instead of skill, and oddities instead of tasteful expressions, are now the most acceptable forms for monumental purposes.

CONFEDERATE SOLDIERS' MONUMENT,
SAVANNAH, GA.

One of these unfortunate structures is found in the Confederate Soldiers' Monument, at Savannah, Ga.

It resembles a frightfully-formed and heavily emblem-ladened church steeple. Designed and executed by Robert Reid, of Montreal, Canada, it is fifty feet high, made of Nova Scotia sandstone, and cost, with freight and duties $21,250.



Confederate Soldier, Savannah, Ga. D. Richards, Sculptor.

It was unveiled May 24, 1875. As originally built, it was surmounted by a statue of Italian marble, and another statue of the same material was enclosed in the column-supported canopy section of the monument. It was also intended to place marble statues of Confederate soldiers on the corners of the die.

In 1878 Mr. G. W. Renne, a citizen of Savannah, proposed to the Ladies' Memorial Association, through whose exertions the monument had been built, that, with their consent, he would have a bronze statue of a Confederate soldier made and placed upon the summit of the monument in place of the marble statue, at his own expense. Consent was given, and the present statue placed in position May 21, 1879. At the same time the statue in the canopy was removed, and the opening closed with stone.

The statue bears on its plinth the words: "D. Richards, Sculpt. 1879.—M. J. Power, Founder, N. Y."

The entire cost of the statue has never been made known, though the sculptor received for his work the lordly sum of $500. It is one of the unnumbered figures executed since the Civil War, by a sculptor without professional reputation, and for a monument contractor. That it has more character than any figure of a soldier in the whole country is saying very little in its favor. It is more direct and complete in its conception, and has more individuality than any statue in the United States, the Jefferson, by David d'Angers, barely excepted.

As a soldier, he is worn out, and conquered. As a man, he faces the future with sad but firm countenance. The upright modesty of the body, the uncertainty of the action of the arms and lifeless hands, and the unaffected general position of the whole figure, make it a Confederate soldier, and nothing else. They also show that the sculptor has comprehended his subject with the perception of a master. In all that which makes a work of sculpture in distinction from a piece of modelling, it is far superior to the Farragut, by St. Gaudens. The latter may be any admiral, and then no more than illustrative in its design, while the soldier is a Confederate, and nothing else. It is also a symbol. The rude shoes and the tattered and overworn clothes have a true and appropriate force. It is really the only statue that has come out of the Civil War.

The Pulaski was the last public monument of importance that Launitz executed. From the time of its erection to the close of his life he was engaged, almost wholly, on private work. He employed, until the breaking out of the Civil War, about thirty men, mostly foreigners. In 1861, he had no American in his employ. The designs he executed included a large variety of the best styles of monuments known in the art. It is the regret of the writer that he found it impossible to get illustrative examples of these works. Some of Launitz's best monuments went to small graveyards in the country, and to family burial places on private estates. This was especially true of the South. His best private shaft monuments are found in Greenwood, in the lots of the Gunther, Harrison, Brooks, Havemeyer and Woods families.

The competition for War Monuments that began as early as 1862, was conducted on principles that Launitz could not practise, or contend successfully against. He stood no chance with the sharp business contractors who introduced the mongrel structures that were set up at Gettysburg, Providence, and in many other cities of the North.

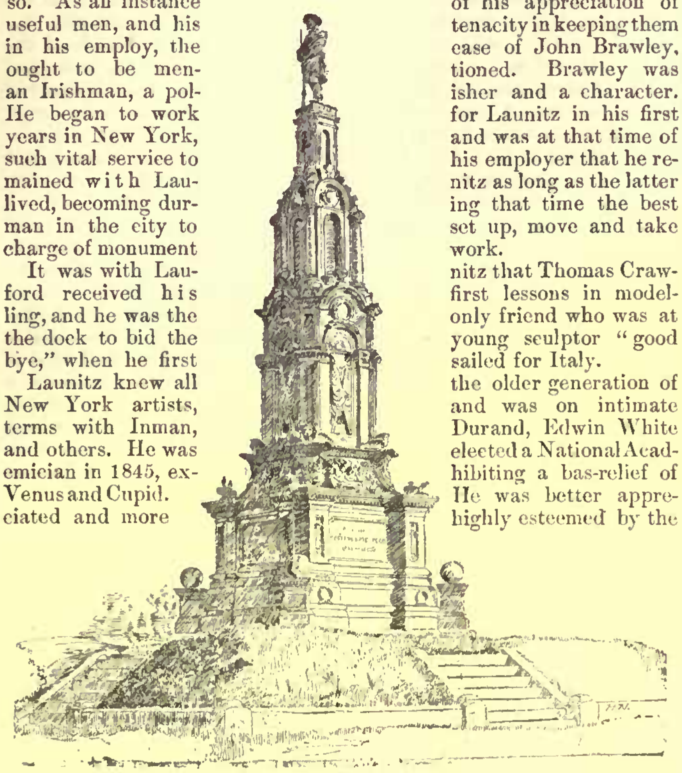
The day of artistic study and integrity, as represented by Launitz, was passing away, and the period of business enterprise, adroitness, and personal influence with committees had begun. He loved his art, cared little for money, and despised the low tricks of the energetic, and unscrupulous Yankee. He almost always failed to ask enough for his work, and was ever tempted to give more than he received.

He employed the best workmen in the country, and taught many apprentices. One of the very best assistants he ever had was F. J. Maurer, now, and for many years past, an esteemed teacher in the Cooper Institute School. Another, was John Korwan. Both very capable all round men, who could model beautifully, make designs equally well, and cut marble in the same way. Casper Buberl was one of Launitz's most skilful carvers. He has since became a popular sculptor employed by monument contractors, and shows an illustrative talent quite superior to sculptors of more distinguished repute. Another of his pupils was —— Baerer, an excellent modeller and carver. He also works at sculpture, and is well known in the monument trade. Launitz's workmen in the early days were generally Italians, and among them were Scregrini, Butti, and many others of like talent. John McAllister, at present the most extensive

granite dealer in New York, served his time as a carver with Launitz, and afterwards became his partner. Up to 1860, very few of the foreign skilled workmen who came to New York did not work for Launitz. It gave him pain to let one go. He wanted to make monuments for a world and ought to have been permitted to do so. As an instance of his appreciation of useful men, and his tenacity in keeping them in his employ, the case of John Brawley, ought to be mentioned. Brawley was an Irishman, a polisher and a character. He began to work for Launitz in his first years in New York, and was at that time of such vital service to his employer that he remained with Launitz as long as the latter lived, becoming during that time the best man in the city to set up, move and take charge of monument work.

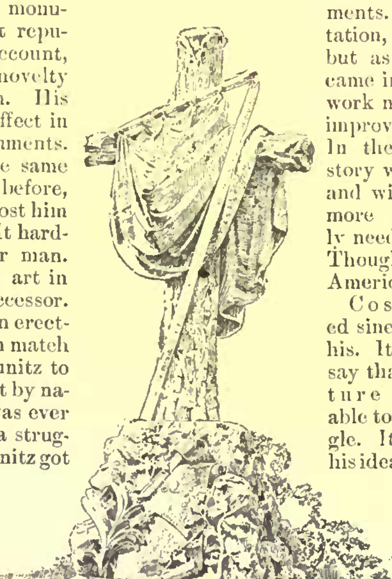
It was with Launitz that Thomas Crawford received his first lessons in modelling, and he was the only friend who was at the dock to bid the young sculptor "good bye," when he first sailed for Italy.

Launitz knew all the older generation of New York artists, and was on intimate terms with Inman, Durand, Edwin White and others. He was elected a National Academician in 1845, exhibiting a bas-relief of Venus and Cupid. He was better appreciated and more highly esteemed by the



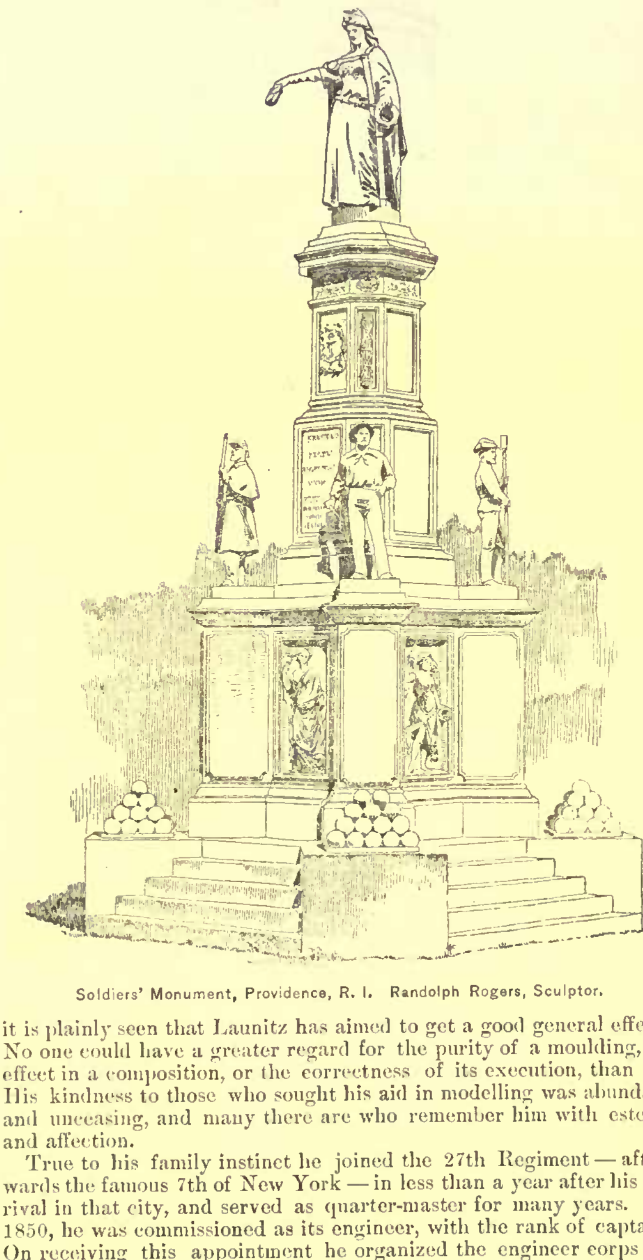
Confederate Monument, Savannah, Ga., designed by Robert Reid.

best people of the South, than by those of the North. The fire of art-enthusiasm, the extravagance of sentiment, and the social temperament of the warm-blooded Russian, were more agreeable to the Southerner than to the Northerner. Throughout all his life there were but a few instances where he was employed solely because he did the best work, or because his clients knew or cared about the excellence of his monuments. Having acquired the best reputation, people went to him on that account, but as fast as the fashion for novelty came in, his old customers left him. His work never seems to have had any effect in improving public taste in monuments. In the majority of cases it was the same story with him as it has often been before, and will always be, that his work cost him more than he received for it. It hardly need be said that he died a poor man. Though the father of monumental art in America, he leaves no worthy successor. Costlier monuments have been erected since his day, but few of them can match his. It is due to the memory of Launitz to say that he was far more competent by nature and acquirement than he was ever able to express. His whole life was a struggle. It has been suggested that Launitz got his idea of shaft mon-



Confederate Monument, Lexington, Ky.

uments from Schinkel, a distinguished German architect. Others have suggested that they were simply obelisks, with the addition of cap and die. Those most familiar with his individual treatment of other monumental forms assert that his shaft monuments grew out of his natural taste for tall structures, and that the large number that he made represent his persistent attempts to obtain the best expression of that form. We agree with the latter view. Although Schinkel has a high reputation as an architect, his studies of shaft monuments resemble a series of panelled boxes, piled one above another, with thin, meagre mouldings, all producing anything but the effect of a monumental whole. In every one of his tall monuments



Soldiers' Monument, Providence, R. I. Randolph Rogers, Sculptor.

it is plainly seen that Launitz has aimed to get a good general effect. No one could have a greater regard for the purity of a moulding, its effect in a composition, or the correctness of its execution, than he. His kindness to those who sought his aid in modelling was abundant and unceasing, and many there are who remember him with esteem and affection.

True to his family instinct he joined the 27th Regiment — afterwards the famous 7th of New York — in less than a year after his arrival in that city, and served as quarter-master for many years. In 1850, he was commissioned as its engineer, with the rank of captain. On receiving this appointment he organized the engineer corps of the regiment, and commanded it with great ability until 1860, when he resigned.

Launitz died December 13, 1870, and was buried in Woodlawn Cemetery, near New York. A simple piece of stone, just large enough to contain his name, birth and death, is all that marks his grave. The man who made so many noble memorials, and helped to carry to posterity the names and deeds of those who deserved a living remembrance, has not so much as the shadow of a cenotaph to honor his final home.

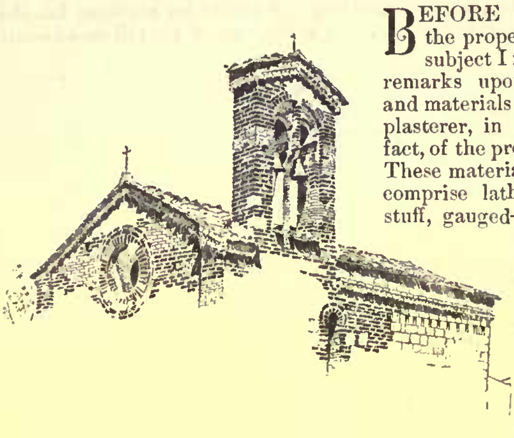
Frazee is even less remembered, for no one knows where he was buried.

T. H. BARTLETT.

EFFECT OF THE ELECTRIC LIGHT UPON BOOKS. — Professor Wiesner of Vienna has just called attention to an inconvenienee attending the use of the electric light in libraries. It has been found that a large number of works in the library of the Technical School had become very yellow, and this led the director of the establishment to ask Professor Wiesner to ascertain the cause of it. Experiment has shown that the coloration is due to light, but that it occurs only with paper containing ligneous substances, such as wood, straw and jute, and that it does not take place when, through some chemical process, the lignine that forms the essential part of the wood is removed. The yellowing is due to a phenomenon of oxidation. Solar light acts more energetically than dispersed daylight, which itself exerts but a very slight action when it is much diffused, and especially in a very dry room. Gaslight is nearly harmless, by reason of the few refrangible rays that it contains. On the contrary, as the are electric light, and, in general, all intense luminous sources, emit numerous refrangible rays, they favor the yellowing. As regards the preservation of papers, then, it will be well to choose gas rather than the electric light for the illumination of libraries. — *Revue International de l'Electricité.*

HINTS FOR BUILDERS.[1]—IV.

MASONRY AND MASON'S WORK.



From the Architect. Bell Turret, Asciano, Italy.

BEFORE going on with the proper division of the subject I must make a few remarks upon the mixtures and materials employed by the plasterer, in continuation, in fact, of the preceding chapter. These materials and mixtures comprise laths, hair, coarse-stuff, gauged-stuff, stucco, rough-cast, and scagliola. Laths are usually made of Baltic fir or spruce, the younger trees being cut into lengths and split down the centre, and it is in this form that lath-wood is imported. The laths are split from these logs, and are classed according to their thickness, as single — $\frac{3}{16}$ inch thick, lath-and-a-half-lath, $\frac{1}{4}$ inch thick, and double laths $\frac{3}{8}$ inch thick. They are usually between three or four feet in length, and one inch in width, and are sold in bundles containing nominally 100 good laths, and should be free from all shakes, knots, or splits. Oak and iron laths are occasionally employed, and sawn laths have the advantage of being of a uniform thickness, and require less mortar on them to set a level surface. The disadvantage, however, with them is that they are liable to break off short.

Hair is usually ox-hair obtained from the tanner's yard. It should be long, strong and sound, free from all grease and dirt, and should be well beaten before being used, in order to separate the hairs.

Coarse-stuff, or what is known as hair-mortar, is made by mixing two parts of sand to one of lime, one pound of hair being added to every two or three cubic feet of mortar. It is employed for the first coat in two-coat work, or for the first and second coat in three-coat work. The quantity of hair should be such that when the mortar is taken up on the trowel it will hang over the edge without dropping off. The stuff for walls does not require so much hair as that for ceilings. Fine-stuff is pure lime, slaked with a small quantity of water, and afterwards thinned with water till it is of a creamy subsistence. It is then left to settle in a vessel made purposely, when the water runs off and evaporates. It is employed for the setting or finishing coat in ordinary plastering.

Putty is fine-stuff made fit for use. In some cases it is prepared rather differently from fine-stuff by running it through a fine sieve.

Gauged-stuff, or putty and plaster, is fine-stuff mixed with plaster-of-Paris in the proportion of three of fine-stuff to one of plaster, more of the latter being employed if quicksetting is required. It must be mixed in small quantities, and is employed for cornices, mouldings, etc. Too much plaster must not be used, as it causes the work to crack through setting too quickly; and in all cases where plaster-of-Paris forms a constituent, too much must not be mixed at one time as it loses its virtues by exposure and mixture.

Stucco is of four kinds, known as common, trowelled, bastard and rough. The first, or common stucco, is composed of three or four parts of clean, washed sand to one of lime; when coarse sand is used with the lime, and the finished surface is roughened with a hand-float covered with felt it is called rough stucco. Trowelled stucco is composed of fine-stuff and sand, two-thirds of the former to one-third of the latter, very clean; it is used for the finishing of surfaces which it is intended to paint. The addition of a little hair to this makes bastard stucco. Rough-cast is sand-grit, or gravel, washed and mixed with hot lime and water. It is employed in a semi-fluid state.

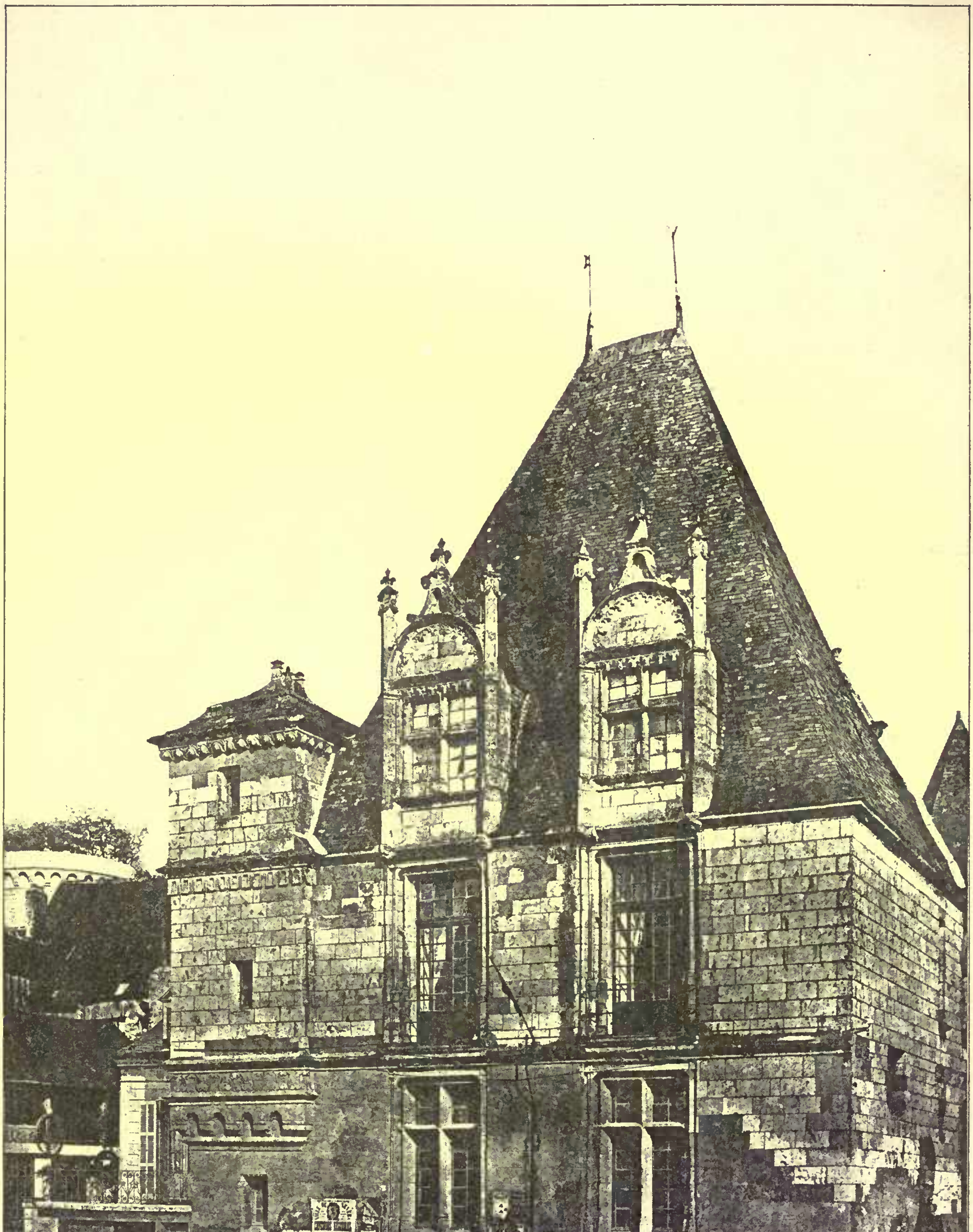
Scagliola, or imitation-marble, is plaster-of-Paris mixed with different coloring-matters in a solution of glue or isinglass, and is used for columns, pilasters, and walls. The surface to be covered is first pricked up, or rendered, with ordinary hair-mortar, and the prepared surface-mixture is then applied. After it has become thoroughly hard it is rubbed down with pumice-stone, a wet sponge being used to keep it damp and clean; it is then rubbed with tripoli and charcoal, polished with a felt rubber dipped in tripoli and oil, and finished with a piece of felt dipped in oil only.

Ornaments in plaster are made either in plaster-of-Paris, composition, carton-pierre, or papier maché, plaster ornaments being cast in wax or plaster moulds. The ornaments are first modelled in clay; when this has became somewhat hard it is put into a wooden frame suited to it, and retouched to make it perfect, and well oiled all over. Melted wax mixed with resin is then poured into the frame, covering the model, and is then left to get cool and firm; the whole is then dipped into water, and turned upside down, when the wax mould comes freely away from the model, and is ready to be used for casting. For running mouldings the mould is generally made about one foot long, as the castings are more easily taken from them than if made of greater length. The casts are made of the best quality of plaster, and the moulds are well oiled.

Plaster moulds are generally employed for large undercut ornaments, as they can be broken up. A clay model is made as above detailed, and the plaster is fitted on to it in pieces; when dry the whole is immersed in boiling linseed oil. Composition ornaments are made by mixing together resin and oil; this is put into glue dissolved in water; whiting is then ground to powder, and made of the consistency of soft putty; upon this the mixture of oil, resin, and glue is poured, and the whole is forced into box-wood moulds carved to the pattern. Carton-pierre and papier maché are used for large ornaments on account of their extreme lightness. The first is composed of paper pulp mixed with whiting and glue, and forced into moulds, they are then backed with stout paper, and placed in drying-rooms to become firm. Papier maché is made in two ways. (1) Sheets of paper are fastened one over another with glue, and forced into metal moulds of the shape required: sometimes a mixture of paper pulp and resin is first put into the moulds, and then the sheets of paper; this makes the lines of the ornament clearer and sharper than the paper alone. (2) Pieces of paper are boiled and made into a paste mixed with size, and forced into the moulds by a counter mould; the ornament is thus made of a thickness of about one-fourth inch. Although lathing is very often considered a portion of the plasterer's work, still in many places it is pursued as a separate trade. All laths should be fixed about three-eighths inch apart, the ends should not overlap, and they should be fixed with zinc nails at every point of support — this last necessity is not so often borne in mind as it should be.

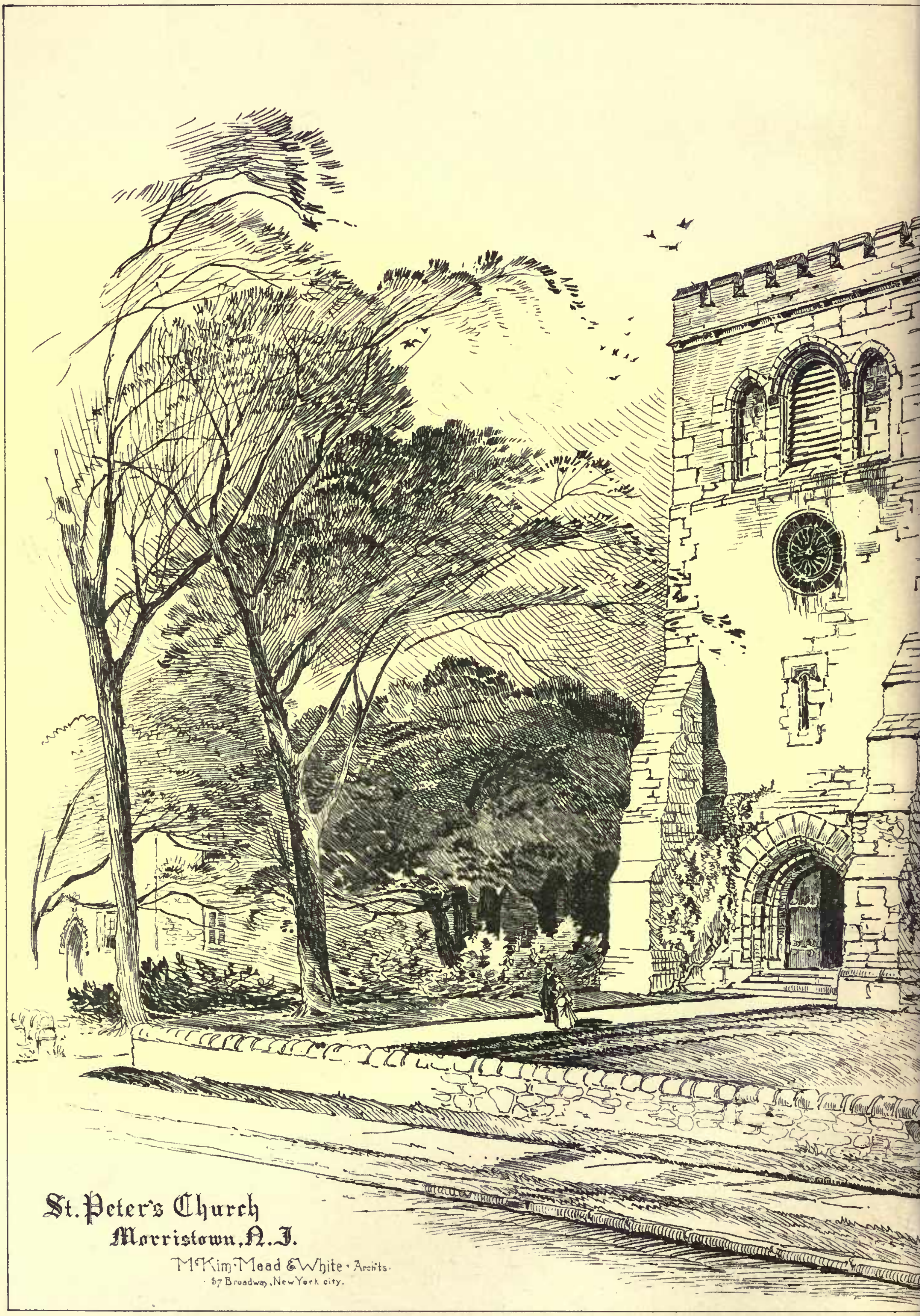
Having now touched upon plastering in all its details, I shall proceed now to a consideration of masonry and masons' work. Masonry is the art of shaping and uniting stones for the various purposes of building, and though there has been some dispute over the derivation of the word *mason*, it is now generally accepted as having come from the Latin *maceria*, a long wall; while it also appears to be the same word as *maison*, a house or mansion. Masonry includes the hewing of stones into the various forms required, and the union of them by level, perpendicular or other joints, or by the aid of cement, iron, lead, or any other substance or mixture. The operations of masonry require much practical dexterity, together with a certain amount of knowledge of the laws of geometry and mechanics. Probably the earliest masonry is that of the Egyptians, which is in the main remarkable for the extraordinary size of the stones employed, which are often as much as thirty feet in length, and fitted without the aid of mortar, and this not because this composition was unknown. The Cyclopæan masonry alluded to by Homer, some remains of which exist at Mycenæ and at Tiryns, are formed of large and irregularly shaped blocks of stone, with the interstices filled with smaller pieces. Etruscan masonry consists of irregularly shaped masses of stone fitted together with perfect exactitude, and of this description of masonry the more ancient remains of Greece and Italy afford very numerous examples. The next improvement in masonry appears to have been in working the stones so as to make the joints or beds horizontal, or nearly so, while the vertical joints were made straight, but not perpendicular to the horizontal ones, specimens of this sort being found at Fiesole and elsewhere. All walls of this kind were put together without the aid of mortar. For the ordinary purposes of walling, the Greeks and Romans employed several methods, such as the *incertum*, now known as rubble, made with stones of irregular shapes and sizes; the *opus reticulatum*, so-called from its network appearance, and formed with square stones laid diagonally; *isodomum* and *pseudisodomum*, in which the stones were formed in regular courses — in the former of equal height, but unequal in the latter; and *emplectum*, in which only the facings were uniform, the centre being filled up with rubble. In all these descriptions of masonry, the stones were small and laid in mortar, much of which has lasted to our own day. The Romans were very partial to courses of tiles in their masonry, the flat surface making a good bond. After the Romans quitted Britain, the masonry in all probability consisted of the coarsest rag or rubble work. In a few of the early buildings, considered by some authorities to be Saxon work, the quoins, the jambs of doors and windows, and, at times, other parts, which are built of hewn stone, are formed of blocks alternately laid flat and set up on their ends, the upright ones being usually of considerable length in proportion to the others, hence the term of long-and-short work applied to this system. In the early Norman style walls were built on the inside face with rubble plastered, and the outside was often the same; in large buildings this was frequently of ashlar, with wide coarse joints, and the mortar made with coarse unsifted sand or gravel. In the early part of the twelfth century the masonry generally improved, the mortar was finer, the stones were set with close fine joints, and ashlar was more generally used for the external, as also for the internal work. Throughout the Norman style the stones of the plain ashlar work more generally approached to cubes in shape, and the courses varied from about six to nine or ten inches in height, while in rubble walls herring-bone work was frequently employed. In late Norman work the stones used in the facings of walls were cut into various shapes for the sake of ornament, the simplest being the *opus reticulatum*, in which the stones were reduced to squares and laid angularly. In the Middle Age masonry the stones were very seldom larger than could be lifted by a couple of men, and they were often small enough to be lifted by one man only. On the expiration of the Norman style,

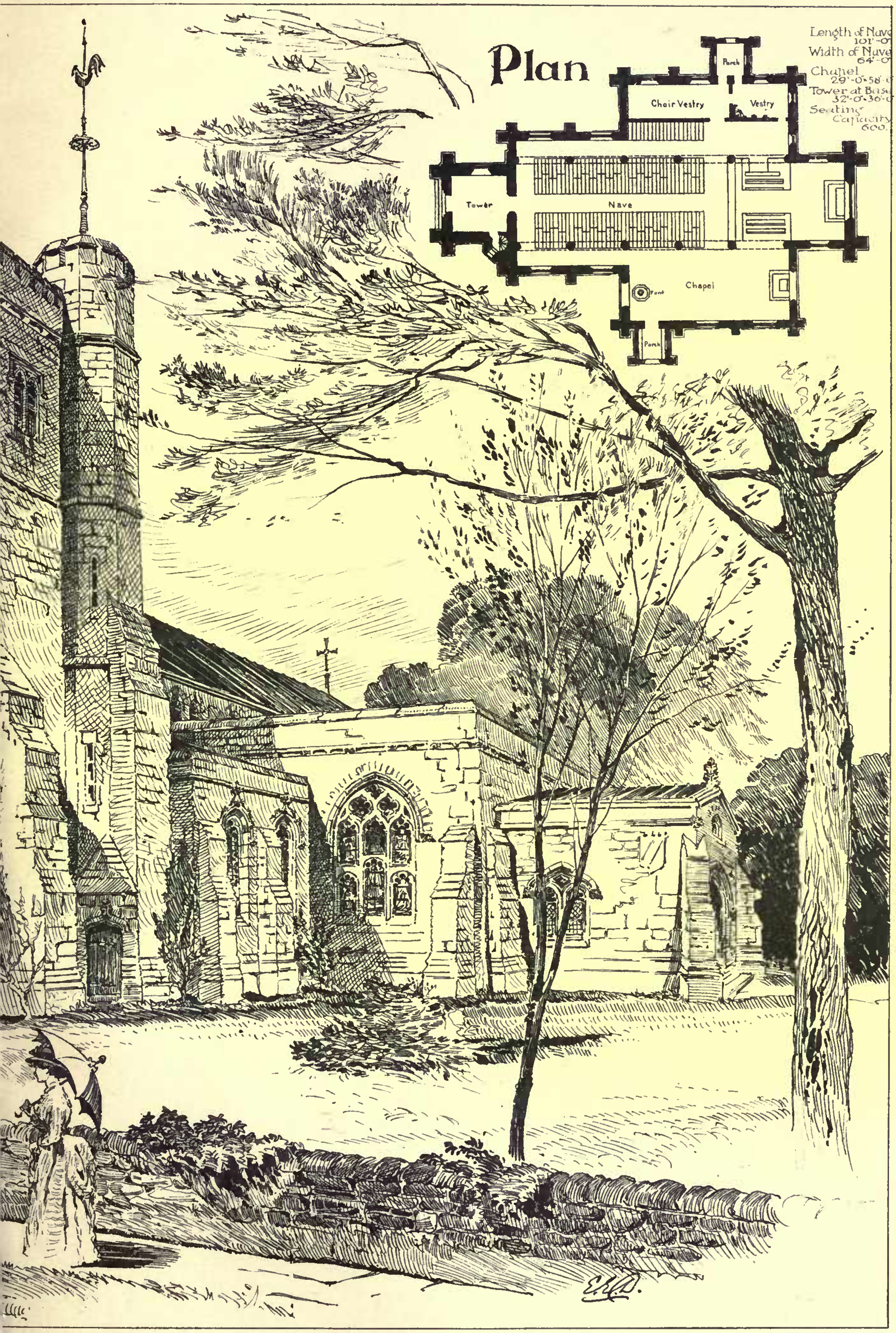
[1] Continued from page 63, Number 606.



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masonry had no characteristics sufficiently decided to mark its date, except where flints were used.

Although a variety of descriptions of masonry are practised at the present day, they can all virtually be classed under three heads, rubble, in which the stones are used without being squared; coursed, in which the stones are more or less squared, sorted into sizes, and ranged in courses, and ashlar, in which each stone is squared and dressed to given dimensions, this last term in London being generally applied to a thin facing of stone placed in front of brickwork, though the technical terms vary in different parts of the country, and in the United States.

In the general modern practice of stone walling, the bedding joints should always be horizontal, when the top of the wall is to be terminated horizontally. In bridge building and in the masonry of fence walls upon inclined surfaces, the bedding joints may follow the general direction of the work. The footing of stone walls should be constructed with stones as large as can be conveniently procured, squared and of equal thickness in the same course, with the broadest bed downwards. The vertical joints of an upper course must break joint, that is, must not fall on those below. If the walls of the superstructure be thin, the stones comprising the foundations may be so disposed that their length may reach across each course from one side of the wall to the other. Where the walls are thick and stones cannot be procured of a sufficient length to reach across the foundations, every second stone in the course may be a whole stone in breadth, and each interval may consist of two stones of equal breadth, as in bricklaying when employing a header and stretcher alternately. If these stones cannot be procured, a header and stretcher must be laid alternately from one side of the wall, and from the other side another series of stones in the same manner, so that the length of each header may be two-thirds, and the breadth of each stretcher one-third of the breadth of the wall, and so that the back of each header may come in contact with the back of an opposite stretcher, and the side of that header may come in contact with the side of the header adjoining the said stretcher. In foundations of some breadth, for which stones cannot be procured of a length equal to two-thirds the breadth of the foundation, the work should be so built that the upright joints of any course may fall on the middle of the length of the stones in the course below, and so that the back of each stone in any course may fall on the solid of a stone or stones in the lower course. The foundation should consist of several courses, each decreasing in breadth as they rise by offsets on each side of three or four inches in ordinary cases. The number of courses is of course regulated by the weight of the wall, and by the size of the stones composing these foundations or footings.

Rough rubble masonry, whether set dry or in mortar, consists of stones of small dimensions, upon which very little labor has been bestowed, and that only in quarrying. None of the stones should be larger than a man can lift, and a good worker can always find a place handy for all such stones. Rough or random rubble masonry may be set dry or in mortar, but dry it forms fence and retaining-walls or protects foundation-walls from clay, marl, or wet earth; amongst forms of this description of masonry may be specified random rubble set dry, in mortar, or with quoins, joins and architraves levelled in courses; snecked rubble, also set in courses; rubble with ashlar binders, in alternate courses with bricks or tiles; flint rubble, whole or cut, and boulder or pebble rubble, used whole or cut, when brick, tile or stone quoins or courses are employed therewith.

Slate rubble is set in horizontal beds, having an angle of forty-five degrees. In random rubble the stones are used just as they are taken from the quarry, any sharp projection being struck off with the scabbling hammer, and what bond there is being simply obtained by the inequalities of adjoining stones fitting into each other. Good mortar and carefully-adjusted stones, not being afraid to employ large ones, will ensure good sound, durable work. In coursed rubble masonry the stones are but little dressed, or not at all, as usually they are brought from the quarry and are sorted into heaps according to size. They must be carefully laid in good mortar, with headers and stretchers, so that they break joint, while chips of stone are employed to fill up any unsightly cavity. In ashlar masonry stones of larger size are employed than in the preceding styles of stonework. The least depth of each block in ashlar should be twelve inches. All the stones must be carefully dressed, and particular attention paid to the joints, in order that the courses should run truly parallel and horizontal. In the better class of ashlar masonry the faces of the stones are "rubbed."

The upper part of a top stone is termed the "top bed," and the under portion the "lower bed," the front being called the "face," and the vertical joint opposite to the face the "back." "Headers" and "stretchers" are employed alternately in each course. Stone-cutting may be practised in a variety of ways, the formation of as many plane surfaces as may be desired, with the least possible loss of material, being the end and aim of all. In dealing with a block of stone, its bed, which is usually one of the largest sides of the block, should be first formed, and reworking always obviated as far as practicable. Care should also be exercised that the beds of stones are never worked concave, as in that case the pressure will be borne on the elevated edges, and there will be a tendency in the stones to flush or break off in flakes at the joints, which has a very detrimental appearance upon the work, beside imparting the idea of want of stability in the wall. Convexity of bed, if very slight, is to be preferred to concavity, but of course a perfectly level surface is best of all. And I would here remind the reader that it were well to make himself acquainted thoroughly with advanced handbooks dealing fully with the matter, for the mason, if he desire to become something more than a mere hewer of stone or rough waller, should study these works and should also aspire and practise to become a thoroughly efficient and artistic draughtsman, while he should also thoroughly master the problems of Euclid, as the processes by which the forms of the various blocks of stone employed in any considerable edifice are based upon strict geometrical principles and laws.

Walls are most commonly built with an ashlar facing and backed with brick or rubble work, this being especially the case in those places where stone is expensive. Walls faced with ashlar and backed with brick or rubble are very liable to become convex on the outside from the greater number of joints, and consequently from the larger quantity of mortar placed in each joint, as the shrinking of the mortar is in proportion to the quantity. Such a wall is, therefore, inferior to one wherein the facing and backing are of the same kind and constructed with equal care, even supposing both sides to be of uncoursed rubble, which is the worst description of walling. Where a wall consists of an ashlar facing outside and the inside of coursed rubble, the courses at the back should be as high as possible, and the beds should contain very little mortar.

Coursed rubble and brick backings admit of the introduction of bond timber; but wooden bonds should not be continued in length, for, unless employed sparingly, they weaken the masonry, making the wall exceedingly liable to bend. It is better to introduce only such small pieces, with the fibres of the wood perpendicular to the face of the wall, as are required for the fastenings of dressings and battens. The ashlar facing the stones usually rise from twenty-eight to thirty inches in length, twelve inches in height, and eight or nine inches in thickness. Although the upper and lower beds of an ashlar, as well as the vertical joints, should be at right angles to the face of the stone, and the face, bed and vertical joints at right angles to the beds in an ashlar facing, yet, when the stones run nearly of the same thickness, it is of more advantage, in respect of bond, that the back of the stone be inclined to the face, and that all the backs, thus inclined, should run in the same direction, since a small degree of lap is thus obtained in the setting of the next course, whereas, if the backs are parallel to the front, no lap can take place when the stones run of an equal depth in the thickness of the wall.

It is also of advantage to select the stones, so that a thick and a thin one follow each other alternately. The disposition of the stones in the next superior course should follow the same order as in the inferior course, and every vertical joint should fall as nearly as possible in the middle of the stone below. In every course of ashlar facing in which the backing is composed of brick or rubble, or in cities where stone is dear and difficult to obtain, bond or through-stones should be introduced, their number being, of course, in proportion to the length of the course; and each of these stones, if in a superior course, should fall in the middle between every two like stones in the course below. In piers, where the jambs are coursed with ashlar in front, every alternate jamb-stone should go through the wall with its bed quite level. If the jamb-stones are of one entire height, as is very often the case when architraves are wrought upon them, and also upon the lintel crowning them, every alternate stone of the stones at the ends of the courses of the pier which are to adjoin the architrave-jamb, should be a bond-stone, and if the piers be very narrow between the apertures, no other bond-stones will be necessary in such short courses. With wide piers the number of bond-stones must be proportioned to the space. Particular attention must be paid to bond-stones in courses above and below windows and all other openings. In such cases their sides must be parallel and perpendicular to each other, and their horizontal dimension in the face of the work not less than the vertical one. The vertical joints, after receding about three-quarters of an inch from the face of the work with a close joint, should widen gradually to the back, so as to form hollow wedge-like spaces for the mortar and packing. The adjoining stones should be fixed with thoroughly good mortar. All the stones of an ashlar facing should be laid on their natural beds; unless this be attended to, the stones are apt to flush at the joints, and this promotes decay from the action of the atmosphere. Where walls or isolated pillars of small dimensions are to be carried up, the stones should be bedded quite level, and not concave, or the joints will flush, and it is an advantage, where practicable, to make every course in the masonry of a pier or pillar in one stone. The next best arrangement to have the courses as few as possible, the joints hidden to the greatest possible extent, and the grain to run in one direction. Vertical joints on columns must never, under any pretext, be permitted.

On the art of dowelling I shall not now touch, as the forms and methods of these are so many that it were best for the mason to pursue his own plan; the most usual is to have them of hard stone run with cement or with iron, and then run with lead, half of the dowel being, of course, in each stone. The same remark will also apply to joggles and the various other methods of uniting stones.

Besides the saw, the mason uses chisels made of iron, with a steel-cutting edge, a wooden mallet, a level, or plumb rule, a bevel, a square, straight and circular rules of various descriptions, and at times the pointer, the boaster, the inch tool and the broad tool, while scabbling hammers are at times also required.

With this my remarks upon masonry — which I must again impress upon my readers are only intended for students and juniors — must terminate. In my next I shall deal with warming and

ventilation, the present concluding really the builders' section of my series.

W. N. Brown.

[To be continued.]

THE ILLUSTRATIONS

[*Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.*]

THE LINCOLN BUILDING, LINCOLN STREET, BOSTON, MASS. MESSRS. CUMMINGS & SEARS, ARCHITECTS, BOSTON, MASS.

[Gelatine print, issued only with the Imperial Edition.]

ST. PETER'S CHURCH, MORRISTOWN, N. J. MESSRS. MCKIM, MEAD & WHITE, ARCHITECTS, NEW YORK, N. Y.

THE building is in an advanced stage of construction. Local stone is being used for the exterior, the interior being faced with Pittsburgh yellow brick. The traceried windows are of stone and the glass is set directly into the tracery.

The chapel has a stone floor, there being no pews, but chairs, and is intended for the smaller services of communion, marriage, funeral, baptism, etc.

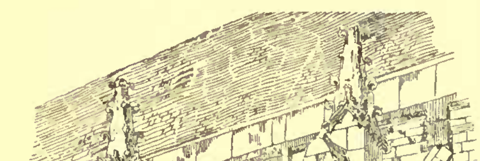
The church will seat six hundred persons, and the estimated cost of the building is $125,000.

OLD PROVIDENCE BANK BUILDING, PROVIDENCE, R. I.

THE PRATT INSTITUTE, BROOKLYN, N. Y. MESSRS. LAMB & RICH, ARCHITECTS, NEW YORK, N. Y.

HOTEL DE VILLE, AMBOISE, FRANCE.

AMERICAN MARBLES.[1]



S.E. PORCH, ST GILLES. CAEN.
AFTER A DRAWING BY MR F D BEDFORD IN THE BUILDER.

THE rise and progress of the marble trade in the United States of America has been of a most extraordinary character. The first marble quarry in the country was opened in Vermont in 1785. Shortly before the year 1800, works were erected for the sawing of marble at Marbledale, near New Milford, Conn. It is said that the first tombstone made out of American marble was erected in 1790, and was the work of one Jonas Stewart, a marble-cutter of Dorset. An examination of the headstones in the graveyard at New Milford proves that the oldest of them are of sandstone from the Connecticut Valley, and of slate. Those of somewhat later date are of marble, and have been evidently worked by hand from the rough block. Those bearing a date soon after the beginning of the present century have been cut on one or both sides with a saw. The date of the first working of American marble is, therefore, fixed with tolerable certainty, and it is evident that a trade which has now assumed enormous proportions has been built up in less than a century.

Marble is now used for building purposes in the States on a scale which may astonish the architects of the Old World. In New York it is superseding the brown freestone or sandstone, of which such a great part of the city is built. The great bulk of the trade centres in Vermont. In that State the quarries are worked with every mechanical means which the ingenuity of man has been able to devise. In the year 1882 it was calculated that the capital invested in the production of American marble in the States of Vermont, Massachusetts, Connecticut, New York, Pennsylvania, Maryland and Tennessee was £2,500,000 sterling, two-thirds of which was invested in quarries, and one-third in mills and machinery. The number of workmen engaged was 6,000, and the annual production amounted to 2,200,000 cubic feet, valued at £900,000.

The principal workings in Vermont are at Sutherland Falls, Rutland and Dorset. The Sutherland Falls marble is mottled and veined in a manner peculiar to itself. Some of it is dark, with a ground of deep blue with nearly black veins. Another variety is nearly white with clouded veins. Both descriptions are sound, and take a good polish. Quarrying operations were commenced in 1836, although they were not pursued with much spirit until some years later. The quarries are well situated, above the railroad and mills, so that blocks are readily transported. The falls of the Otter are made use of as a motive power to drive the saws, the polishing-beds in the finishing-shops, and the drills in the quarry. It was here that the first successful channelling-machine was employed. These machines are now in operation all over the States. It is calculated that since 1863 over five millions of square feet have been cut by them. The channeller is a locomotive machine which runs on steel rails placed on the quarry floor. The gang of cutters forming the drill is composed of five steel bars, 7 feet to 15 feet long, sharpened at the ends, and securely clamped together. The centre cutter is the longest, and the two outside cutters are the shortest, so that the five form a kind of stepped arrangement away from the centre. As the machine runs backwards and forwards over the rails the cutters deliver their strokes at the rate of 150 per minute. Deep, narrow furrows are cut into the solid stones, and long parallel blocks are thus formed. Close after the channeller runs the gadding-machine. This drills circular holes along the bottom and sides of the blocks, into which wedges are introduced, and the stone is split from the bed. The Wardwell channelling-machine, which is most commonly in use, cuts a continuous groove at the rate of 75 to 150 square feet per day, thus doing the work which could be done by 50 to 100 men by the old hand-process. The expense of working the machine is about £2 per day. The advantages gained by use of the machines are therefore obvious. The diamond gadder does its work at the rate of 180 feet per day, as against 12 feet by hand labor. Three men are required for each channeller, and two for each gadder. As a consequence of this mode of getting the stone, the quarry appears like a hollow cube cut into the hill. The sides are nearly perpendicular walls, and the bottom is a marble floor over an acre in extent. Across this floor the channelling-machines work.

Sutherland Falls marble is much used for building purposes. The spire of Grace Church, New York, is built of it. The formation of the beds gives great opportunities for the extraction of large blocks. A small town has been built near the Falls for the accommodation of the workers.

At Rutland a pure white marble is found. There are several quarries in the neighborhood of the town, and the marble bears a high reputation. There are quarries of clouded and veined white, and of dove-color as well as statuary. The marble is found on the western slope of a range of low hills running north or south. The thickness of the beds worked varies from 50 feet to 120 feet. They are inclined at an angle which averages about 45°.

Quarrying operations were commenced in the year 1838, and a few years later trade in "Rutland marble" had become firmly established. The deposits proved to be abundant and of sound quality, and were sources of large profits to the proprietors. The marble industry of Rutland has been a prosperous one, and at the present time it is calculated that some 2,000 men find employment in the quarries, mills, and workshops. Rutland statuary is said to be too soft for ordinary purposes. This complaint may possibly arise from the fact that the principal supply has hitherto been produced from the upper layers. It is now claimed that the lower layers have produced a statuary which is of a much better texture than any formerly worked. At the State House in Montpelier there is a statue of Ethan Allen of heroic size; this is the work of Larkin J. Mead, and is sculptured out of Rutland marble. The marble is certainly not so easy to work as that of Italy; it is what is called "plucky" —that is, given to breaking away before the chisel, unless great care is used.

The sand-blast was first employed for the cutting of marble at some marble works in West Rutland in 1875–76. A contract was taken by which 254,000 lettered headstones, having dimensions of 3 feet in length, 10 inches in width, and 4 inches in thickness, were placed in the national cemeteries at an expense to the government of about £173,000. The monuments were for the purpose of marking the graves of soldiers, and the application of the sand-blast for the purpose of cutting the inscriptions, enabled the work to be so cheaply done. Letters and figures of chilled iron were placed on the stone to be cut, and the blast was then turned on; the portions of the stone unprotected by the iron were eaten away by the force of the blast, and the inscriptions were left standing in relief. By this method the name, company, regiment, and rank of a soldier could be put upon a stone in less than five minutes of time.

Between Rutland and Sutherland Falls there is found the quarry of the Columbian Marble Company. This marble is almost black,

[1] One of a series of papers on "Marble and Marble-Workers," by Arthur Lee, published in the *Building News*.

but with a mottled surface; it is much used for mantelpieces and monuments.

At Pittsford there are three beds or veins of marble which run through the town north and south. The east bed is of the same character as Sutherland Falls marble, of which bed it is probably a continuation; the middle bed is separated from the easterly one by about 200 feet of limestone rock. This bed is about 400 feet wide, and contains marble of all shades, ranging from white to dark blue. Marble from the Pittsford quarries has been used in the construction of several large buildings at Boston — notably, the Continental Building, Commonwealth Hotel, and the Blackstone National Bank Building.

About a mile to the south of Pittsford some marble is quarried known as "Florence marble." It is dark-blue in color, mottled, and veined. The quarries were first opened in 1880, and the production rapidly assumed large proportions. In 1884 it was calculated that the output was nearly 10,000 tons.

Another dark, dove-colored marble is found at Brandon. Several quarries have been opened near this town, but only one is now in active operation.

At Middlebury there are extensive deposits of white marble, which some years ago were very largely worked. Little in this way has been done of late, as the marble, although of good color, has proved to be so generally unsound that the working of it has not been remunerative.

The first attempt to manufacture marble upon a large scale which was made in the States originated in Middlebury. In a history of this town, by Judge Swift, there is an interesting quotation from a pamphlet written by Professor Frederick Hall, and published as long ago as 1821, which is as follows:

"Proceeding down the creek on the western side, after passing two saw-mills, two grist-mills, a clothier's works, and some other establishments of minor importance, you come to a marble factory. The marble of this village, which is now wrought on a large scale, and is extensively approved over the country, was discovered by Eben W. Judd, the present proprietor, as early as 1802. A building on a limited plan was erected, and machinery for sawing the marble was thus put in operation. In 1806 a new and commodious building, two stories high, and destined to comprise 60 saws, to be moved by water, was erected. In 1808 this enlarged establishment went into operation, and has continued to the present day.

"The saws are made of soft iron without teeth, and are similar in form to those which are used for sawing marble by hand in the large cities in Europe. The marble, until lately, has been obtained chiefly from a quarry situated within a few feet of the mill. It is raised from its bed partly by means of wedges, but principally by blasting. The marble, after being sawed into slabs, is manufactured into tombstones, curriers' tables, panels, mantelpieces, hearths, window and door caps and sills, sideboards, sinks, and various other kinds of furniture. These articles are transported to Montreal, Quebec, Boston, New York, and even Georgia. The machinery has sawn annually from five to ten thousand feet since the year 1808."

At Lanabee's Point, in Shoreham, Addison County, there are deposits of black marble which closely approach Kilkenny marble in appearance. The quarries are not now in active operation, but several polished chimneypieces made of it are to be found in some of the older houses in the neighborhood. At one time it appears to have been in much favor.

La Motte marble is another black marble of similar character, but more fossilized. It is found near the west shore of the Island of La Motte in Lake Champlain. It is in considerable demand for the making of flooring-tiles, and finds some employment for monumental purposes.

At Swanton, in Franklin County, there is found a dove-colored marble, which was much used for gravestones down to the year 1850. In that year the workings were abandoned, as the quarries could not compete with those opened at Rutland.

South of Rutland the celebrated Dorset marbles are found. These are situated near the town of that name in Bennington County, Vermont, and are, for the most part, worked in the sides of Dorset Mountain, or Mount Eolus. This is a mountain of marble with a cap of slate on the top. The slate is estimated to be 498 feet in thickness, and the limestone and marble 1,970 feet. Some 200 feet below the slate, white marble used for building purposes is quarried, and 400 feet lower a fine-grained white marble is found which is in great request for monumental purposes. The first quarry was opened in 1785, and saw-mills were erected in South Dorset in 1818.

Before that date the stone was taken from the top or outer edge of the layers, where the strata could be readily split into flags of a thickness of some four or five inches. These flags were then worked up into the required shape with mallet and chisel. When once sawing-plant was in full swing, the harder layers of stone were worked, and the sawn marble found a ready market. In 1840, before the introduction of Italian and Rutland marble, the demand for Dorset marble was beyond the supply.

What is known as Vermont Italian marble is worked up the mountain at East Dorset. This marble is almost exclusively used for monumental and decorative purposes. The production reaches an annual average of over 30,000 cubic feet.

A quarry known as the Freedley Quarry, situated a little farther to the north, has been worked since 1820, and is still producing a white marble much used for building purposes. The quarry is high up in the mountain, and the blocks are sent down by means of an inclined railroad. The annual production of the Freedley quarry averages 40,000 cubic feet.

PRIX DE RECONNAISSANCE DES ARCHITECTES AMÉRICAINS.

April 24, 1886.

Dear Sir, — It is proposed that those architects who, during the last forty years, have pursued their professional studies in Paris, whether as students at the École des Beaux-Arts itself, or as students in the *ateliers* attached to it, shall signify their sense of the obligations under which they stand to the Government and people of France by uniting to establish in the school a perpetual benefaction, to be enjoyed by Frenchmen only, under the name of the Prix de Reconnaissance des Architects Américains, and the undersigned have formed themselves into a Committee to further this scheme and carry it into execution.

The books of the École des Beaux-Arts contain the names of forty-six Americans who have been received into the school in the section of architecture, and have enjoyed free of cost all the rights and privileges established by the Government for the benefit of its own citizens, with the single exception that the Grand Prix de Rome is not open to them. But they have been admitted to compete for other prizes, seven founded in the school itself and five in the Académie des Beaux-Arts, with an aggregate annual value of more than fifteen thousand francs, besides having access to the lectures, the library and the collections.

An equal number of American students have been admitted to the different public and private *ateliers* who, without entering the school, have profited by the generosity with which it is administered, and have been inspired by the atmosphere it has created.

It seems time that something were done, not to requite these benefits, for that would be impossible, but to show that we are not ungrateful for them. Whatever is done should be done without ostentation, but it should be done handsomely and upon a scale befitting a public recognition of benefits publicly bestowed. A subscription of fifty or a hundred dollars apiece from such of us as can afford it, with larger sums from the more prosperous, and such aid from other persons as they may be disposed to offer, seems to be a proper basis on which to proceed. This would bring in from five to ten thousand dollars, according to the cordiality of the response. Less than the smaller sum would not be adequate to the occasion; more than the larger is not to be specially desired. This is about the range of the foundations already existing in the school.

The international character of the enterprise is calculated to give it interest and importance in the eyes of the public, and several persons not connected with the school, or even with the profession, to whom a knowledge of the scheme has been confided, have spontaneously expressed a wish to be allowed to contribute to the fund. It may well happen that some of the past students of the school who most eagerly sympathize with the undertaking, but cannot from their own means make the subscriptions they would wish, may be able, by interesting some of their friends or clients in the work, to more than make good the deficiency of their own contributions.

Subscriptions may be made either in a single sum or by quarterly instalments, to begin on the 1st of June. No subscription will be called for until the success of the undertaking is assured. Answers to this circular may be sent either to the Secretary, or to any of the undersigned.

Until success is fully assured it is obviously undesirable that anything should be said about the undertaking in public. You will please consider this accordingly as a personal and confidential communication, and will use all possible precautions to prevent any mention of it in newspapers or periodicals.

The list of names and addresses herewith enclosed is necessarily imperfect and erroneous in many particulars. Will you kindly forward to the Secretary any information in your possession which will render it more complete.

In case their endeavors are successful, of which they are not willing to entertain a doubt, the undersigned will take the responsibility of entering into communication with the authorities of the École des Beaux-Arts, with a view to arranging the statutes regulating the bestowal of the prize so as to conform to their usages. A report of this action and of its results will be sent to each subscriber.

Richard M. Hunt	New York, N. Y.
Alfred H. Thorp	New York, N. Y.
Charles F. McKim	New York, N. Y.
Henry O. Avery	New York, N. Y.
Thomas Hastings	New York, N. Y.
Henry H. Richardson	Brookline, Mass.
Robert S. Peabody	Boston, Mass.
Arthur Rotch	Boston, Mass.
William Rotch Ware	Boston, Mass.
William E. Chamberlin	Boston, Mass.
Harrison W. Lindsley	Connecticut.
Theophilus P. Chandler, Jr.	Philadelphia, Pa.
John Stewardson	Philadelphia, Pa.
J. B. Noel Wyatt	Baltimore, Md.
J. C. Hornblower	Washington, D.C.
Edward A. Kent	Buffalo, N. Y.
Louis H. Sullivan	Chicago, Ill.

George L. Healy - - - - - - Chicago, Ill.
John M. Donaldson - - - - - Detroit, Mich.
Albert Pissis - - - - - - - California.
G. T. Snelling - - - - - - Paris.
Richard H. Hunt - - - - - - Paris.

Whitney Warren, - - Newport, R. I., *Secretary.*

PRIX DE RECONNAISSANCE DES ARCHITECTES AMÉRICAINS.
AUXILIARY SUBSCRIPTION.

East Forty-Ninth Street, New York.

Dear Sir, — We enclose, by permission, a circular which has lately been sent to all the architects in the country who have pursued their professional studies in the *ateliers* attached to the School of Fine Arts in Paris. It proposes that they shall show their sense of the obligations under which the school has placed them by establishing in it a prize to be called the Prix de Reconnaissance des Architectes Américains, as a permanent expression of their gratitude to the Government and people of France.

It appears that a fund of ten thousand dollars is needed to do this as it ought to be done, for if done at all, it should be done handsomely. The chief part of this sum it will probably not be difficult to obtain from the men, nearly a hundred in number, who have studied in Paris, and whose names are to be found upon the list which follows the circular. But there are four or five times as many who are, like ourselves, the pupils of these *Elèves*, belonging, so to speak, to the second generation, who also recognize the École des Beaux-Arts as the ultimate source of much that it has most profited them to receive, and who may properly ask to share in this acknowledgment. For our own part we are not willing that it should go forward without our coöperation, and believing that many of our fellow-students will feel as we do about it, we invite you to unite with us in making up an auxiliary subscription, supplementary to the other, which shall put the success of the undertaking beyond a peradventure, and make sure that the gift shall be worthy of the occasion.

Subscriptions of five or ten dollars each, with fifty or a hundred from such of us as can afford it, would make up a sum which, though not very large in itself, would add greatly to the significance as well as to the amount of the fund. Indeed, nothing could so much enhance the value of the undertaking, regarded as an act of international courtesy, as that it should be promoted by numbers of students in every part of the Union, who are personally strangers to the school.

Please bring this to the attention of any persons who are likely to take an active interest in the undertaking, but as a premature publicity is obviously not to be desired, please consider it as a personal and confidential communication, and use every endeavor to prevent mention of it in newspapers or periodicals.

A report of what has been accomplished will be sent to each subscriber.

William R. Ware, *Secretary*, School of Mines,
and others.

New York, August 19, 1887.

Dear Sir, — A joint meeting of the Committee and of the Auxiliary Committee was held at Mr. Hunt's office, in this city, on Saturday the 5th of March.

The Treasurer, Mr. H. O. Avery, reported that out of the ninety-one men who were named upon the circular sent out a year ago as having studied architecture in Paris, either at the École or in some of the *ateliers* attached to it, five had died, two had sent word that their names had been included in the list by mistake, and there were seven whose address had not been ascertained. Nineteen others had not yet subscribed to the fund, though some of them had expressed the intention to do so. From the remaining fifty-eight about thirty-five hundred dollars had been received in sums varying from five to two hundred and fifty dollars.

The auxiliary subscription, organized by the pupils of the men who had been in Paris, had amounted to about seven hundred dollars in sums ranging from five dollars to a hundred. Here also some persons who had signified their intention of adding to the fund had not yet done so.

To these sums a number of persons, both in the profession and out of it, had added about twenty-five hundred dollars in sums varying from twenty-five dollars to two hundred and fifty. This they had given out of sympathy with the undertaking and from a desire to take part in a notable act of international courtesy.

The question before the Joint Committee was whether to close the subscription and send the seven thousand dollars at once to Paris. This would obviously leave the amount of the fund at a smaller figure than was desirable, and would deprive some persons of an opportunity to take part in the enterprise who had expressed a wish to do so. On the other hand, though the matter had so far been kept out of the newspapers, they might publish it at any moment, and there was danger that a knowledge of the scheme might thus prematurely reach the other side of the water. It was finally resolved to keep the subscription still open, but to ask Mr. Hunt, as Chairman of the Joint Committee, to put himself in communication with the authorities of the École des Beaux-Arts, informing them of what had been done and asking their acceptance of the gift.

This he at once proceeded to do, employing as his messenger his son, Mr. R. H. Hunt, a member of the committee, now a student in the school. In reply he has received the two letters which follow.

The first is from the Director of the School, to whom his letter was addressed. The second is a more formal acknowledgment from the Minister of Public Instruction and of the Fine Arts.

Paris, le 21 Mars, 1887.

Monsieur le President :

Vous avez pris soin de m'adresser, au nom des architectes des Etats-Unis, un chèque de trente-cinq mille francs dont l'intérêt constituerait, pour les élèves architectes français, un prix annuel qui serait initulé : "*Le prix de reconnaissance des architectes américains,*" Je suis très touché de votre généreuse pensée et vous prie de vouloir bien agréer pour vous et vos compatriotes l'expression de notre vive gratitude. J'écris aujourd'hui même à Monsieur le Directeur des Beaux-Arts pour lui demander, suivant nos règlements, l'autorisation d'accepter cette importante donation. Veuillez agréer, Monsieur le Président, l'assurance de mes sentiments les plus distingués.

Le Directeur de l'Ecole des Beaux-Arts, Membre de l'Institut.

P. DUBOIS.

Palais-Royal, le 7 Avril 1887.

Monsieur :

Monsieur le Directeur de l'Ecole Nationale des Beaux-Arts m'a transmis la lettre que vous avez bien voulu lui écrire pour lui annoncer qu'un certain nombre de vos compatriotes, pour la plupart anciens élèves de cet établissement, ont souscrit une somme de trente-cinq mille francs destinée à la fondation d'un prix annuel auquel ils désireut donner le titre de "*Prix de reconnaissance des architectes américains,*" à décerner aux élèves français.

J'ai l'honneur de vous faire savoir, Monsieur, que j'accepte avec empressement cette donation, en attendant que, conformément aux lois en vigueur, elle soit définitivement acceptée par Décret du Président de la République rendu en Conseil d'Etat. Je vous prie, en même temps, de vouloir bien être auprès de Messieurs les souscripteurs l'interprête de mes plus vifs remerciments et de ma sincère gratitude pour cette marque généreuse de sympathie donnée aux élèves de notre École Nationale des Beaux-Arts, qui garderont de leurs camarades américains un précieux et durable souvenir.

Agréez, Monsieur, l'assurance de ma considération la plus distinguée.

Le Ministre de l'Instruction publique et des Beaux-Arts,

BERTHELOT.

Moreover, in the annual report of Mr. Paul Wallon, Secretary of the Société Centrale des Architectes, read at the École des Beaux-Arts on the 10th of June, occurs the following passage : —

"Notre école donne sans compter, elle accueille sans distinction d'origine ni de nationalités tous ceux qui viennent à elle ; toutes les parties du monde sont ses tributaires.

"Cette générosité lui a valu de nos confrères américains un témoignage tout récent de gratitude. Par l'entremise de leur président, M. Richard M. Hunt, — membre libre de notre Société,— les architectes des Etats-Unis viennent de fonder nn prix annuel qu'ils demandent d'intituler : *Prix de reconnaissance des architectes américains.*

"La lettre qui accompagne cette donation est rédigée dans les termes les plus flatteurs, les plus touchants, spécifiant que les donateurs désirent fonder ce prix, en faveur des élèves français *seuls*, pour mieux accentuer leur gratitude envers la France.

"Ce sont là, pour notre France, de précieuses et douces paroles qui consolent de bien des injures, de bien des injustices."

It will be seen that the offer of this gift has been received with the greatest satisfaction, though its official acceptance must await the completion of certain formalities. Meanwhile it is hoped that at least another thousand dollars may be added to the fund. Several hundred have been received since the March meeting.

A complete list of all the subscribers will finally be transmitted to Paris. Yours truly, WILLIAM R. WARE,
Secretary of the Joint Committee.

PRESENT LIST OF SUBSCRIBERS.

STUDENTS ADMITTED INTO THE ECOLE DÉS BEAUX-ARTS.

1846 Richard M. Hunt.
1863 Edward D. Lindsey.
1864 Alfred H. Thorp.
1868 Robert S. Peabody.
Charles F. McKim.
Sidney V. Stratton.
1872 J. Rogers Rich.
1873 William B. Bigelow.
Albert Pissis.
1874 George R. Shaw.
Arthur Rotch.
Walter Cook.
Louis H. Sullivan.
Henry O. Avery.
1875 Henry A. Phillips.
William Rotch Ware.
1876 Lindley Johnson.
1877 Henry D. Hunnewell.
1878 Clarence H. Blackall.
William M. Whidden.
Charles I. Berg.
1879 William E. Chamberlin.
Edmund R. Willson.
William A. Otis.
A. D. F. Hamlin.
1880 Alex. W. Longfellow, Jr.
Thomas Hastings.
John M. Carrère, Jr.
1881 John Stewardson.
1882 Bernard R. Maybeck.
1883 Arthur L. Tuckerman.
1884 Frank C. Huidekoper.
1885 Grenville T. Snelling.
Richard H. Hunt.

STUDENTS IN THE ATELIERS.

1860 Maurice Fornachon.
1861 William G. Preston.
1864 Edmund Quincy, Jr.
John A. Mitchell.
W. T. Winslow.
1867 Francis W. Chandler.
1868 John P. Putnam.
George T. Tilden.
1869 Theo. P. Chandler, Jr.
1873 Robert G. Shaw.
J. B. Noel Wyatt.
1874 Henry P. Clark.
Edgar C. Curtis.
1875 Edward H. Greenleaf.
Edward S. Thacher.
Warren R. Briggs.
J. C. Hornblower.
1876 John M. Donaldson.
George H. Wetherell.
1877 W. B. S. Clymer.
Edward A. Kent.
1880 Alexander I. Finkle.
1885 Whitney Warren.
Charles B. Perkins.
1886 Samuel W. Mead.
George Cary.

PUPILS OF STUDENTS AT THE ECOLE AND IN THE ATELIERS.

1859 George B. Post.
Henry Van Brunt.
Wm. R. Ware.
1868 Theodore M. Clark.
1870 Stanford White.
1875 A. J. Boyden.
William B. Tuthill.
1876 M. J. Brown.
Robert D. Andrews.
Arthur G. Everett.
1877 Pierce P. Furber.
Herbert Jaques.
E. M. Wheelwright.
1878 F. E. Zerrahn.
1879 William A. Aiken.
Francis H. Bacon.
H. L. Warren.
1880 Henry I. Cobb.
Cass Gilbert.
1881 C. A. Coolidge.
C. A. Gifford.
Charles A. Rich.
William C. Richardson.
George F. Shepley.
D. W. Willard.
1882 Edward T. Newton.
J. S. Rogers, Jr.
1883 Edward F. Ely.
1884 William D. Austin.
1885 W. C. Noland.
1886 Joseph E. Chandler.
Henry B. Shope.
1887 William A. Boring.
Edward P. Casey.
John T. Walker, Jr.
Pupils of Mr. Hunt, Mr. Richardson, and others.

1868 Frederick Brooks.
Stephen C. Earle.
1869 George A. Avery.
1870 G. Wilton Lewis.
1871 L. H. Gibson.
1872 Francis Skinner.
J. A. Wilson.
1873 Glenn Brown.
W. H. Dabney, Jr.
Bernard Vonnegut.
1875 R. D. Chapell.
1876 H. S. Josselyn.
E. H. Taylor.
1877 A. W. Brunner.
1878 Frank H. Beebe.
Silas R. Burns.
Arthur B. Cram.
Clarence H. Johnston.
Thomas O'Grady, Jr.
William Zimmerman.
1879 George L. Heins.
William Kauffman.
1884 Lyman Farwell.
Joseph B. Gay.
George C. Harding.
1885 Henry D. Bates.
Henry F. Bigelow.
William W. Bosworth.
Simon B. Eisendrath.
Edwards J. Gale.
Thomas R. Kimball.
Frank B. Meade.

1885 Wilson B. Parker.
Dwight H. Perkins.
William Proctor, Jr.
Annie G. Rockfellow.
George C. Shattuck.
Murray Smith.
George W. Stone.
Everett K. Taylor.
Frederick S. Taylor.
1886 William S. Aldrich.
John W. Bemis.
F. Earle Calkins.
John W. Case.
A. W. Cobb.
Charles H. Converse.
Charles W. Dawson.
H. C. Dittrich.
Charles R. Edgerton.
Arthur V. Edwards.
J. Edward Fuller, Jr.
David P. Goodrich.
Irving T. Guild.
Joseph J. Hall.
Adolph Hallenberg.
Howard G. Hodgkins.
Richard Hooker.
George C. Kaufman.
Daniel D. Kearns.
Walter H. Kilham.
A. W. LaRose.
Charles R. LaRose.
Frank H. Martin.
Frank L. Packard.
Herman Parker.
Charles B. Pitman.
Theodore W. Pietsch.
William G. Plumer.
John H. Rankin.
Clary E. Ray.
Robert R. Snow.
Herman W. Tamkin.
Paul H. Tracy.
Oliver F. Wadsworth, Jr.
George C. Wales.
Pupils of Mr. Chandler and Mr. Létang, at the Massachusetts Institute of Technology.

1881 Willard P. Little.
Alvan C. Nye.
1882 Thomas Nolan.
M. J. O'Connor.
1883 S. B. P. Trowbridge.
1884 Stockton B. Colt.
Harry E. Donnell.
John A. O'Connor.
Edward C. Robinson.
1885 John S. Appleby.
Charles A. Bechstein.
A. R. McIlvane.
O. L. I. Rogers.
Arthur A. Stoughton.
Allen Tucker.
1886 Charles T. Mathews.
Samuel T. Skidmore.
1887 A. M. Hadden.
William S. Post.
Pupils of Mr. Hamlin, at the School of Mines, Columbia College.

FRIENDS AND OTHER ARCHITECTS.

Edward D. Adams.
Hicks Arnold.
Samuel P. Avery.
John C. Bancroft.
Martin Brimmer.
Daniel H. Burnham.
F. D. Carley.
Walter Cope.
H. C. Fahnestock.
Robert Goelet.
Edward H. Kendall.
Charles Lanier.
H. G. Marquand.
Henry C. Meyer.
Levi P. Morton.
Mrs. E. T. Potter.
Leoni W. Robinson.
John W. Root.
John H. Sturgis.
Russell Sturgis.
Charles S. Smith.
James F. Sutton.
J. J. Van Alan.
Cornelius Vanderbilt.
Wm. K. Vanderbilt.
George W. Vanderbilt.
C. Howard Walker.
Harry Walters.
Wm. T. Walters.
Mrs. George H. Warren.
Theodore Weston.
George P. Wetmore.
Mrs. Henry Whitman.

SOCIETIES

THIRD EXHIBITION OF THE ARCHITECTURAL LEAGUE.

152 FIFTH AVENUE, August 1, 1887.

THE Third Annual Exhibition at the Fifth Avenue Art Galleries, 366 and 368 Fifth Avenue, adjoining the Stewart Mansion, New York City, will be open to the public on Monday, December 19, 1887, and will continue for three weeks. The exhibition will consist of work not before exhibited in New York City, and representing, as far as practicable, the work of the past year.

CONDITIONS.

The exhibition shall be devoted to architecture and the allied arts, as may be represented as follows: Architectural designs; perspective drawings; sketches in pencil, pen-and-ink, water-colors, charcoal, etc.; elevations and photographs of executed work; sketches for interior decoration and furniture; designs and cartoons for stained glass; mural decoration and paintings of foreign work.

EXECUTED WORK.

Stained glass; wood carving; mosaic, and casts and models of executed architectural and decorative work.

A detailed circular of blanks as to jury, framing, transportation, etc., is now being prepared, and can be had after October 1st, on application to the Secretary.

By order of the Executive Committee.

CHARLES I. BERG, *Secretary.*

COMMUNICATIONS

THE INDIANA SOLDIERS' AND SAILORS' MONUMENT.

INDIANAPOLIS, IND., August 24, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT:—

Dear Sirs, — Our Commission is building the Indiana Soldiers' and Sailors' Monument, not the Indianapolis Soldiers' Monument, as you have it in your last issue. The State is furnishing the money, and should have the credit.

Yours respectfully, GEO. W. JOHNSTON.

INDIANAPOLIS, IND., August 25, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT:—

Dear Sirs, — To state a fact, and to correct a misstatement or mistake of your correspondent who wrote from this city on August 10, over the signature of "Monument," will you please state that the name of Professor W. R. Ware, who has been selected as one of the experts and professional advisers of this Commission, was not first proposed to the Commission by "Monument," as he states, nor by any architect nor by any one who will be a competitor in the competition to furnish a design or for the work. Several persons having publicly claimed to have been the first to suggest the name of the first expert selected, it seems necessary to disabuse their minds and those of any who may contemplate entering the competition. Professor Ware's name having been for some time under consideration by this Board, it was practically decided on before the receipt of the many requests coming almost simultaneously from architects, asking that he be appointed, when it became known that the Board was canvassing the matter of the appointment of experts. No architect or prospective competitor either primarily suggested or influenced the selection of either one of the experts.

I enclose you, herewith, a proof of the text of the instructions, etc. As soon as actually ready I will send you a copy containing the phototypes, etc. Please accept our thanks for printing my letter of the 8th, and for the friendly feeling you manifest toward the enterprise.

Very respectfully, etc., J. F. GOOKINS,
Sec'y S. S. & S. M. Com.

RECTOR PIERSON'S GRAVE.

EVERGREEN HOME, ONARGA, ILL., August 19, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT:—

Dear Sirs, — Your correspondent, Mr. T. H. Bartlett, has appealed to me in a communication in the *American Architect* of August 6, 1887, in the following language; to wit, "Having kindly set me right in regard to the grave-stone of one of the sons of the Rector, and stated the interesting fact that many hundreds of his male descendants are living, will Mr. Pierson please state where the ashes of his ancestor do repose, and whether there is any stone to mark the place? Thus enabling me to complete a full statement concerning an important point, the last resting-place of the first President of Yale."

As a preliminary to my reply, I would here state that the base-stones and plinth of the column monument to the memory of Rector Pierson, on Meeting-House Hill in Clinton, Conn., of which there is a representation on page 268 of the *American Architect* of June 4th, were put in place with the view of ultimately crowning them with a sun-dial. With this purpose, this structure was unveiled and dedicated June 7, 1868, though other views finally prevailed in regard to the superstructure. The historian of the occasion states that:

"This monument is the contribution of several gentlemen connected with Yale College and with the New Haven Colony Historical Society, and is the first of a series of fixed land-marks designed to be set up throughout the State in commemoration of important events in our history."

On this occasion large numbers of citizens were present from New

Haven, Clinton, Killingworth, and other towns: Dr. Daggett, President Woolsey, Dr. Bacon, General Wm. S. Pierson, Governor Dutton, and numerous other notable persons read appropriate addresses.

At the conclusion of these exercises on Meeting-House Hill, the narrative runs:

"A procession of the people was formed, headed by Governor Dutton, to visit the graves of *Pierson* and Elliot, *in the old cemetery behind the church.*

"The graves of these worthies were hung with bouquets and wreaths of flowers, fragrant and beautiful. After a look at the old gravestones, and a fruitless attempt to decipher the inscriptions, a benediction was pronounced at the grave of Rector Pierson, by the Rev. Dr. Arms, of Norwich, and the people dispersed.

"The grave of the Rector — a good and learned man — was a fitting spot where to close the ceremonies that commemorated one of the most notable events in the early history of our College, which, from so small a beginning, has grown to be the first institution of learning in the republic."

I would here add to this narrative that the inscription on the grave-stone erected over the grave of Rector Pierson, and which the visitors on this interesting occasion did not succeed in deciphering, reads as follows:

"In memory of ye Rev. Mr. Abraham Pierson, first President of ye College in Connecticut, who deceased March ye 5th, 1706–7."

Such is the information, and all the information, that I have been able to gather in relation to the resting-place of the remains of the first President of Yale College. There is undoubtedly "*a stone to mark the place*," but the inference is that a minute description of it, were I able to furnish one, would hardly interest the artistic readers of the *American Architect.*

Your respected correspondent, Mr. Bartlett, says in the *American Architect* of August 6, page 67, that "my statement [in a previous number] that General Wm. S. Pierson, of Windsor, Conn., was 'the only living male descendant of Rector Pierson, the first President of Yale,' was made to me by the General himself in 1872."

Now there is a strong presumption that your correspondent misunderstood General Pierson in the conversation here referred to. This presumption is based upon the following facts and circumstances:

[Our correspondent goes into the genealogical history of the descendants of Rector Pierson at some length, and closes as follows:]

The writer has personally met many of the descendants of Rector Pierson, in several States of the Union, and he has read and heard of many others.

I think I have said enough, without going into further details in which your readers could feel no interest, to raise a strong presumption that the descendants of Rector Pierson number not only many hundreds, but some thousands; and the probability is that about one-half of them are men, or, in the language of your correspondent, "male descendants."

But I am fortunate in having a word from the General himself, that goes far to show conclusively that he set up no exclusive claim to the sole heirship from the Rector, of the Pierson name, and that your correspondent must have misunderstood him. It will be noted that the conversation with the General in which this remarkable claim is said to have been made, occurred in 1872. Some years before his death, General Pierson sent me a pamphlet containing the address that he delivered in 1868 on the occasion above referred to, of the notable gathering on Meeting-House Hill for the purpose of dedicating the Pierson monument. Near the close of that address, the General said:

"I remember to have seen Deacon Abraham Pierson in my childhood, etc. . . . My honored father, the late Dr. Wm. S. Pierson, was the son of Deacon Abraham. He was a graduate of Yale, etc. . . . If time would permit, I would speak of *some* of the *descendants* of the *old Rector, in other lines than that of my own family, especially as there are representatives of other families present.*"

It should be observed here that this address was delivered on Meeting-House Hill, June 17, 1868, while the conversation above referred to, occurred in 1872, more than four years subsequent. It is hardly presumable that what the General knew about "*the descendants of the old Rector, in other lines than that of his own family*, in 1868, had been entirely forgotten, or was ignored, in 1872."

All the facts and circumstances in the case having been carefully considered, it is pretty evident, I think, that your correspondent's report of the conversation between himself and General Pierson in 1872, does the General serious, though undoubtedly unintentional, injustice.

Very truly yours, Wm. P. Pierson.

NOTES AND CLIPPINGS

Recent Excavations. — The necropolis of the ancient city of Carmona has just been discovered about half a mile beyond the Arab gate of Seville. The inhabitants of Carmona were the most civilized of the Iberian Peninsula several centuries before the Christian era, and it is said that their laws were written in verse. The excavations which have recently been made have resulted in the discovery of a large number of coins, and between the two fields known as the Quarries and the Olive Groves the excavations have brought to light a great many sepulchral chambers, hewn out of the rock, with funeral urns in the sides. The roofs of these sepulchral chambers are some of them vaulted, while others are flat. There are several furnaces either inside or just outside the chambers, and it was in these that the incineration took place, the ashes being placed in black earthenware urns. Among the other objects found was a mirror with a handle, a lamp, a lachrymary, a bronze statue, several pieces of iron, libation cups, nuts, the remains of a repast, and some pipes communicating with the inside and the outside of the sepulchral chambers. — *New York Evening Post.*

TRADE SURVEYS

The month of August has been an exceptionally active and prosperous one, in all of the leading industries. Where large sales and contracts have not been made, inquiries and offers have been received, showing that consumers are ready and anxious to buy as soon as assured that they are safe. An impression has been gaining ground in some quarters, that a reaction in prices is among the immediate probabilities. It is scarcely necessary to discuss or measure the reasons given for this belief. The probabilities all point to strong, if not advancing prices. An advance in prices would, at this time, be a disadvantage to industrial and business interests at large. A temporary decline in prices might do no harm; but might weaken the strong confidence which now exists. Public opinion does not admit the possibility of a permanent advance in any direction; on the contrary, the rapid growth of productive capacity is a reason given why prices, sooner or later, should and must decline. As an illustration of the downward tendency which many declare to exist, it is to be pointed out that steel rails have sold within a few days at $36 at mill. They advanced from $26 to $40 within two years, and have now receded to $36; but a little reaction is already in sight, which will probably permanently land them at $37. The production next year will be in excess of 2,500,000 tons; the demand will be extraordinary. Nearly every mill is straining its capacity. Since the 1st of July, between 3,000 and 4,000 miles of road have been either projected or talked of among capitalists who have the money and determination to build. From all indications, the boom in the iron trade will continue. Much complaint continues to be made day after day, of the heavy foreign importations, and not without some cause. Within the past forty-eight hours, brokers in New York, Philadelphia, and at one or two other points, have received inquiries for material which will aggregate over 100,000 tons. Bessemer pig, rail-blooms, nail-slabs, billets, tin-plate, wire-rods, and even beams are under inquiry, and a heavy demand will very probably set in, regardless of the wishes of American makers. Although foreign beams are three-fourths of a cent lower at tidewater than American beams at mill, the American makers are able to control the trade. The demands from builders for structural iron is fully double what it was a year ago. Bridge-builders are making urgent demands and two or three new works are now projected for rolling shapes; one of them will be located at East Chicago. The pipe-makers have had a remarkably good year, and will meet in a few days to try and advance quotations. The nail-makers of the East met at Philadelphia on Wednesday to lay the basis for an advance, and to take steps to effect a National combination which has been under consideration for some time. The plate and tank iron-makers have been crowded with orders during August, and have more work on hand now than for two or three years. The same is true of bar mills all over the country. The crude-iron industry is in excellent shape and production is increasing. Average tidewater quotations for forge, $17.50. All the other leading industries are gaining strength, and it is possible that in some two or three, winter orders will command better prices. The demand for all kinds of machinery and motive power is exceptionally good. It has been said by persons competent to speak, that three-fifths of all our steam-using establishments are increasing their steam-using facilities. This guess may possibly be wide of the mark; but we are safe in saying in a general way, that a great increase in capacity of all kinds is being made. The lumber manufacturers and dealers, West, East and South, have suffered no obstruction through a clogging condition of markets. Hard woods are much more abundant now than for months; but prices do not seem to recede. Locomotive-builders have had a better August business than for any month for six past. Very late advices from leading car-builders in the West, show that the capacity is not equal to this year's requirements.

The electrical-machinery manufacturers have been crowded with orders for equipments, and machinery of all kinds, especially for Western markets. The supply-houses are short of stock. A great many small municipalities, West and South, are clamorous for motive power and light. The success attending the experiments of introducing electrical-motors, is stimulating demand in many quarters, and the leading electricians in the country are talking of combinations which will very likely result in the establishment of new and larger plants. The textile manufacturers are talking with much more confidence than a month ago. The trade conditions now and then are not different. The fall requirements are more clearly seen, and are fully as heavy as anticipated. A few new mills have been projected since July 1, but there will not be that rush that seemed probable, early in the season. Textile manufacturers have learned by experience, that it is best to make haste slowly, and they are now endeavoring to meet the increasing demands of the market, without going too heavily into plant expansion. The paper-makers have been unable to strengthen prices. In one or two branches, combinations have been of advantage, but the paper-making industry at large, is the victim of an active competition which no trade combination seems able to control. The makers of wood-working machinery, and of tools, as well as the manufacturers of small machinery, are in sight of an immense demand for supplies. Agents who have recently returned from their hunting-grounds, have brought in very heavy orders, and report an abundant demand awaiting future production. It is impossible to find a single industry wherein additional capacity could not be employed. This seemingly extravagant statement will bear a rigid scrutiny. In some localities here and there, dulness exists; but it is due to special and temporary causes. The outflow of money from Eastern financial centres have been so active as to create some apprehensions on the part of lenders. There is no good ground, as has been recently stated, for the fears expressed. The indebtedness of the country at large is relatively lower than it ever has been. What the English term the "outturn" is accomplished more quickly than a few years ago. The improvements in exchange, render business men and manufacturers less dependent upon the circulating medium, than heretofore. There are very few commercial failures, and a more rigid supervision is maintained over money-lending institutions. Speculation is more difficult and dangerous. An increasing production is more easily marketed. Our export trade in crude and finished products, is certainly holding its own, and the fears of overpowering foreign competition which were created a few years ago, are disappearing under the improved agricultural and manufacturing processes which the sharpened wits of Americans put into play.

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CONTENTS

WE are very glad to see that the Commissioners for the Soldiers' and Sailors' Monument for the State of Indiana have exercised the discretion entrusted to them in such a way as to transform the rather forbidding scheme of competition foreshadowed in the preliminary circular into a programme which, if not all that we could desire, is one of the best and fairest ever published in this country, and, if carried out in the spirit which has so far characterized the proceedings of the Commission, ought to secure for the State a design of unusual merit. The two cardinal points of satisfactory competition, the submission of the designs to expert judgment, and the employment of the author of the best design to carry it into execution, have been provided for, under reservation, by the stipulation that the Board of Experts, consisting of Professor Ware of Columbia College, New York, Professor Campbell of Wabash College, Indiana, and General Morris, one of the State House Commissioners of Indiana, shall draw up a report on the designs, with comments and recommendations, and shall assist the Commissioners in their deliberations; the Commissioners promising, on their side, that they will appoint the author of the design placed first supervising architect or sculptor to carry it out, "if, in their judgment, they are warranted in doing so," and that in any case they will adopt no design, and make no appointment, which may be condemned by the Board of Experts. It is so rare a thing in this country for a board of commissioners, however unskilled in any art, to delegate their power of selection entirely to experts that the terms proposed are perhaps as favorable in this respect as could have been expected; and, if carried out in good faith, as we cannot doubt that they will be, we do not see that an honorable architect need hesitate to accept them. The compensation promised to the supervising architect is a commission of five per cent on the total cost of the work, including all sculpture and other decoration, and the embellishment of the grounds. The work required of competitors is made as light as possible, nothing but sketches, on half-imperial sheets of paper, being either required or admitted, and the rendering of these is to be very simple. Ten of the best known architects in the country have been invited to compete, and are to be paid two hundred dollars apiece for their trouble; but designs from architects and sculptors not specially invited will be received and considered.

THE Swiss architects have recently drawn up a set of principles for public competition, which, without being copied from the English, French, Belgian or German codes, agrees with them in all important particulars. The most important, as the committee which drew up the English rules well pointed out, are the two stipulations, that the competing sketches shall be judged by experts; and that the author of the plan placed first shall be commissioned, at the usual remuneration, to carry out his design; and these occupy a prominent place in the Swiss code, modified, however, by the provision that in cases where strong reasons oppose the appointment of the author of the best design, the winner of the second premium may be substituted for him as architect of the executed work. In regard to the reservation, so often made, permitting the promoters of the competition to reject all the designs, under cover of which such outrageous frauds are often practised on architects, the Swiss code says plainly that no "backing out" from a competition, to translate its expression literally, is ever to be permitted. No matter whether the plans submitted are good or bad, the premiums offered must be awarded and paid, to the best if any are good, to the least objectionable if all are bad. This principle, which is contained in several other codes, ought to be more insisted upon than it has been. The most shameful instance of its violation that we remember was in the competition for historical painting held in Philadelphia some years ago, where the judges, after placing the work of a certain artist first, refused to pay him the premium which had been advertised, on the ground that his picture was not, in their opinion, worthy of it; but every one knows of numberless similar cases, and it is quite time for the profession to express its opinion clearly on the matter. It is obvious that if the prize of a competition may be withheld at the pleasure of the judges, a competitor who wishes to succeed must not only send in the best design, but must gain some hold of interest or friendship on the judges, to make sure of not being thrown over entirely after all his pains. It may be taken for granted that the judges will always be disappointed in the result of a competition. In the great majority of cases their disappointment is the result of their own carelessness, ignorance or want of clearness in specifying in the programme just what they wished to have, and what they were willing to leave to the discretion of the designer; but even where they are not at fault in this way, the realization of a scheme always falls short of one's anticipations, and expert judges, even more than laymen, are sure to find points to criticise in the best of the competing plans. Under these circumstances it is natural for imaginative persons to think that the perfect plan, which they are sure awaits them if they could only find the means for discovering it, might be secured by a second effort, in which the mistakes of the first should be avoided; and the temptation to save the prize-money and gain an opportunity for using it in a second venture, by rejecting all the first designs, is too strong for most persons, unacquainted with professional feelings and ethics, to resist. Of course, the knowledge that they are liable to suffer this treatment keeps the best architects out of competitions, just as the Philadelphia farce brought ridicule upon American historical painting, and a contempt upon American juries of fine art, which will not die out for a generation, and it is for the public interest that such matters should be better regulated. There would be few entries for horse-races in which the animals that came in first, after running fairly, were liable to have their prizes denied them because they did not fulfil the judge's expectations; and the same rule applies to more dignified contests. There is no emulation in the effort to please the whim or the fancy of a person in authority, and nothing but meanness and corruption is fostered by the attempt. If we wish to develop the powers of our artists, or avail ourselves of their most strenuous efforts, by matching them against each other, some one must be victor in every contest; and if, as the Swiss architects propose should be done in their competitions, the judges send to every competitor a statement of the reasons for their choice, the vanquished may gain as much good as the victors from the struggle, while the public will profit perhaps most of all.

THE science of calming waves by means of oil is at present being pushed very rapidly to effective results, and, judging from what has already been accomplished, it will not be many years before every sailing-vessel, at least, will carry cans of oil as an indispensable part of its outfit. For yachts and small boats, particularly, the use of oil appears to be of the greatest value. Such craft have, as a rule, little to fear from a lee shore, but are liable to be swamped in a heavy sea by the curling over of a breaking wave upon them, and it is just this which oil effectually prevents. It is a pleasure to find that the Hydrographic Office at Washington, which has bravely kept up the theory of the existence of an American merchant marine, and continues to pursue its investigations with as much zeal as in the days when it helped so efficiently to make American ships and American sailors the best in the world, has taken up

this important subject, and collected a fund of information about it which is being eagerly utilized by maritime nations. Strange to say, the use of oil for stilling dangerous breakers was for many years strictly prohibited by law among these very nations, on the theory that waves temporarily repressed in that way would return afterward with redoubled fury, and it seems to have been reserved for the United States officers to point out clearly the absurdity of this landsman's notion, and, by explaining the true effect of the oil, prepare the way for the abolition of the old Admiralty regulations in regard to the matter, and the promulgation of more enlightened ones.

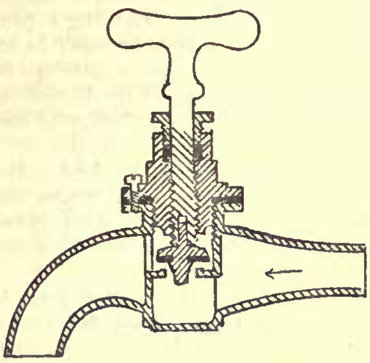
AS it appears, the calming property of oil on water agitated by the wind is due to the lack of adhesion between oil and air, and to the cohesion between the particles of the oil itself. A strong wind blowing over water clings to the surface, and easily separates portions of the liquid, which form spray, and this, mixing again with the water, and carrying down bubbles of air with it, throws the surface into a ferment, reducing the specific gravity of the superficial layers, and rendering them more subject than ever to be caught up by the wind, especially when lifted in waves above the normal level, and blown forward, producing the appearance which we call the curling of the wave, and exposing to destruction a small vessel which may happen to be under the falling mass. If oil is poured upon water in this condition, it spreads in every direction, retaining, however, by the cohesion of its particles, its connection with the nucleus, so as to form an almost unbroken film, over which the wind slips, without being able either to lift it or to act upon the water beneath it, and the waves which are propagated under the film from outside no longer tend to break or curl over, but appear as a heavy, but not dangerous ground-swell. So extraordinary is this cohesive and lubricating power of oil that a film of almost incredible thinness is sufficient to keep the wind and the water apart. It is found by many trials that a ship, driving before a gale, can keep smooth water around itself and for an indefinite distance behind it, with an expenditure of two quarts of oil an hour. Many vessels have done the same with less than one-third this quantity of oil, but, taking the larger quantity, and supposing that the average width of the smooth track is about the same as the width of the ship, which must be far within the truth, and that the film lasts an hour before it is dissipated, we can easily calculate, if the vessel drives at the rate of ten knots an hour, that the two quarts of oil must spread over an area of about two million square feet. A quart contains something over sixty-nine cubic inches, so that the thickness of a film of this size, produced by two quarts of oil, would be about one two-millionth of an inch.

NOT long ago, the French Admiral Cloué collected the reports of our Hydrographic Bureau, and, adding to them some observations of his own, presented the subject before the Academy of Science in Paris, where it excited great interest, and we find an abstract of his discourse in the *Revue Industrielle*. At present, the ordinary way of using oil in storms at sea is to prepare a sailcloth bag, of about ten quarts capacity, and fill it with oakum, saturated with oil. A quantity of free oil is then poured on the oakum, the bag securely closed, and some holes made in the bottom with a sail-needle. The vessel being put before the wind, two such bags are hung over the stern, so that the oil may cover the wake of the ship, and suppress the waves that threaten to break over the stern. This it seems to do with perfect success, the billows ceasing to curl forward under the action of the wind, and becoming simply swells, not dangerous if the ship is properly managed. As, however, an attack may be made from the quarter, instead of directly astern, some captains prefer to hang the bags over the side, a little forward of the stern, or even as far forward as the catheads, so that the rolling and plunging of the ship may spread the oil, and increase the width of the smooth track. If the ship is hove-to, several oil-bags are suspended over the windward side, and the lee-way which the vessel makes soon leaves it protected from the waves by a stretch of smooth water; while some captains have been ingenious enough, by carrying the oil as far forward as possible, to keep on their course, protected on the windward side by the greasy film. As to the sort of oil to be used, it is found that fish oil is most effective, that from seals or porpoises being the best. Mineral oils have answered a good purpose, but are rather too light; and vegetable oils, such as palm oil, sometimes become solid in cold water. It is rather touching, as indicating the desperate straits to which ship-masters are sometimes reduced, to read of the expedients which have been tried; one vessel, for want of oil, having saved itself by pouring varnish on the waves; while others have collected the butter and lard from the galley, and melted it down to throw overboard. However the greasy matter may be obtained, there can be now no doubt of its efficacy. A great number of captains have put their opinion on record that their ships would have been swamped but for the use of oil, and the life-saving boats on the Australian coast have been for several years regularly drilled in running out to sea through the surf on the reefs in bad weather by scattering oil around them. This is done so skilfully by the crews that they row across the reefs as it were through a lane of smooth water, while the breakers rage on each side. In a similar way, the passengers and crew have recently been transferred from a sinking ship to another in a storm by small boats, after scattering oil from the windward vessel until the water between the two became calm enough to be safely navigated by such little craft.

AT the late Congress of French Architects, which took place in Paris, recently, an extremely interesting paper was read by M. Maspéro, the official archæologist of Egypt, and Director of the Boulak Museum, upon the work now going on in the vicinity of Thebes. As every one knows, Thebes was, at one period in the history of Egypt, a city of great importance; and, although, according to M. Maspéro, it could never have had more than a hundred thousand inhabitants, it is said by Herodotus to have had a hundred gates, and, apparently from some idea of its sacred character, formed the centre of an extraordinary group of tombs, monuments and temples. Among the temples, the two largest were situated in villages outside the walls, one named Karnak and the other Luxor. Of these, that at Luxor is much the oldest, having been begun by Amenophis, or Memnon, nearly thirty-five hundred years ago. The temple stood on the bank of the Nile, and soon acquired great fame, so that, like the pilgrimage churches of modern days, it became necessary to enlarge it. According to M. Maspéro, an Egyptian temple, besides being the scene of grand solemnities, was nearly as busy a place as a mediæval convent. Tithes and ecclesiastical fees were usually paid in agricultural produce, so that the building of barns and granaries had to keep pace with the popularity of the shrine; and the priests living in the temple, with an eye to the main chance which is not yet altogether unknown in the world, usually secured from the royal authority some monopoly, such as that of furnishing linen for wrapping embalmed bodies, or of providing all the bread to be eaten by persons attached to the ecclesiastical service, so that the temple became a manufacturing establishment, as well as a storehouse of provisions. All this business needed accommodations, and the famous Luxor temple became a vast group of buildings, partly of stone and partly of sun-dried brick, extending in an irregular line along the river-bank. One hundred and fifty years after the foundation of the temple by Amenophis, Rameses I added to it an enormous vestibule, with the usual interior peristyle, and a colonnaded ante-room, making the whole length nearly a quarter of a mile, and embellished it, after the Egyptian taste, with four huge pylons. Not content with this display of zeal, Rameses I increased the size of the palace-temple already existing in the suburban village of Karnak until it surpassed in size the strictly ecclesiastical group at Luxor, and, finally, united the two by an avenue, more than a mile long, guarded by one thousand sphinxes, which lined it on each side. This extraordinary work soon began to fall into decay, and two hundred years after its completion the palace at Karnak had become also the state temple, and Luxor was abandoned. Some centuries later, Thebes itself was destroyed by the Romans, and the miserable inhabitants took refuge in the ruins of the temples. That at Luxor seems to have afforded them better accommodation than the other, and the great halls were soon subdivided into tenements, while the courts became filled with huts, which perched even on the tops of the pylons. The débris of habitation gradually covered the pavements, until, when M. Maspéro began the work of excavation, he found a population of more than three thousand people living within the temple walls, in huts, which in some instances, stood on a soil raised sixty feet above the original pavement. Before any explorations could be made, it was necessary to expel the inhabitants of the building, and this has been done with some difficulty; but the place is not only now clear, but the excavations are well advanced, and we may expect to hear of valuable discoveries before long.

THE WATER-SUPPLY OF BUILDINGS.[1] — VI.

SUPPLY-FAUCETS.



"Hand-closing" compression-cock, "direct" acting, with loose valve.

COMPRESSION-cocks may be subdivided into "*Hand closing*" and "*Self-closing*" cocks, and each of these classes may again be subdivided into "*Direct*" and "*Indirect*" acting.

The initial-cut and Figure 9 represent "hand-closing" compression-cocks, with "*direct*" action, that is, the valve itself is actuated directly by the movement of the handle of the faucet. These examples differ from that illustrated in Figure 8 only in having a loose valve guided by a small guide-rod loosely fitting into a hole in the bottom of the main stem of the handle. The object of having the valve loose is to avoid the rotation of the valve-cushion and consequent abrasion in closing without the use of the square piston of Figure 8, which greatly increases, by friction, the wear on the threading.

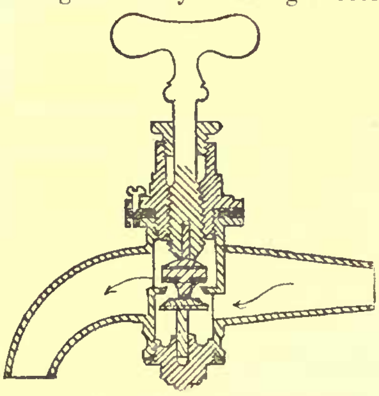


Fig. 9. "Hand-closing" Compression-cock with double Valve.

Unfortunately, this loose construction of the valve involves the serious objection of rattling or hammering when closing under high pressure, and consequently it cannot be recommended. Figure 9 differs from Figure 8 in having a double valve, one above and one below the water porte, so that when the cushion on the upper valve wears out, it may be removed and replaced by a new one without shutting off the water from the rest of the house or using a special shut-off cock, since the lower valve itself serves as a shut-off cock when the main stem is removed. In most cases the increased complication of the double valve more than offsets its advantage.

A better method of obviating the abrasion or grinding of the cushion in closing is to employ some form of lever instead of the screw movement. Figure 10 illustrates a faucet constructed on this principle. The mechanism is, however, here such that the closing is as rapid as that of the ground cock, being governed by a single turn of the handle, whereby under high pressure water-hammer is liable to be produced. The evident advantage of this over the ground-cock is the freedom from injury by grit in the water or accidental marring of its valve surface, which it possesses in common with all compression work, as well as the ease with which its valve is repaired in case of damage.

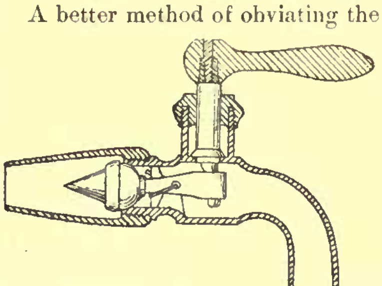


Fig. 10. Compression-cock with direct lever movement.

To obviate all the objections referred to in faucets they should be made *slow closing* under the lever principle of compression work, and act *indirectly*, as will be explained hereafter.

HAND-CLOSING FAUCETS ACTING INDIRECTLY.

Figure 11 illustrates the application of a small auxiliary valve to a hand-closing faucet. By its means the main valve is caused to open and close slowly. The main valve has cast upon its upper surface a piston of larger diameter than itself, which works loosely up and down in a cylinder formed in the body of the apparatus. A very small passage-way connects the cylinder above the piston with the outlet-nozzle of the faucet. This passage-way is opened or closed by a small auxiliary valve operated by the handle of the faucet. In its normal condition the small passage-way stands closed by the auxiliary valve and water stands in the cylinder above the piston, and the main valve is closed by the pressure of the water on the upper surface of the piston. When it is desired to open the faucet, the small valve is opened, relieving the water-pressure from the top of the piston, which causes it, and the main valve attached to it, to rise under the influence of the unbalanced water-pressure below. The speed of opening is governed by the rate at which the water above the piston can escape through the small valve and passage-way. The main valve remains wide open until the auxiliary valve is again closed. Water-pressure again accumulates above the piston and overbalances the pressure on the lower side. This and the weight of the piston cause the valve to close slowly, its speed being governed by the rate at which water can enter the cylinder around the edge of the piston, or, in other words, by the closeness of the fit of the piston in the cylinder. In this manner water-hammer is avoided.

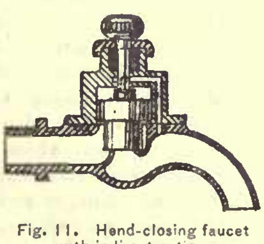


Fig. 11. Hand-closing faucet with indirect action.

[1] Continued from No. 602, page 15.

The objections to this mechanism are, first, the complication arising from the use of two valves, which increases the cost and doubles the chances of leakage, and, second, the liability to stoppage of the minute passage-way through grit and sediment in the water. All water conveyed in service-pipes contains organic and inorganic matter in suspension, in particles varying in size from grains of fine sand and microscopic bacteria to small pebbles, fishes and even full-grown eels. The heavy deposit which collects in the bottoms of house-reservoirs shows the quantity of matter carried even in the clearest water. Therefore, small, unscoured passage-ways and delicate machinery should always be avoided in water-supply apparatus.

SELF-CLOSING FAUCETS.

In order to provide against waste of water through carelessness, ignorance or malice, innumerable devices have been invented, of which we illustrate the leading types. They are all generally known as "self-closing" cocks, and are likely to increase in popularity with the price of water and with the increase of individual responsibility for water-waste through the extension of the private meter system.

The great drawbacks to the use of the self-closing faucets as now generally made are the inconvenience and difficulty of handling them, and their want of durability and reliability. Those which close against the water-pressure and depend upon the tension of a spring to keep them tight, require for handling considerable strength of fingers, so much so as to render their use generally uncomfortable and sometimes even impossible, and it is always annoying to wait with one hand on the faucet until a sufficient quantity of water for use is drawn. The spring must evidently be made strong enough to overbalance the highest water-pressure likely to be encountered, and not only this, but it must have a reserve of strength sufficient to allow for a gradual loss of tension under constant strain, and to ensure tightness at all times, even under sudden shock or water-hammer in the pipes. Now the fluctuations of pressure in water-mains are so great that, whereas at one time the pressure of the spring may be largely offset by that of the water, at another it may be almost entirely unbalanced, and the strength required to operate the valve is then very great. Moreover, it is precisely at that moment when the effort to open the valve is greatest that it must be longest sustained, since it is then that the water runs slowest. Under such a strain the life of the spring is rapidly exhausted, and frequent leakage and need of repair is the result.

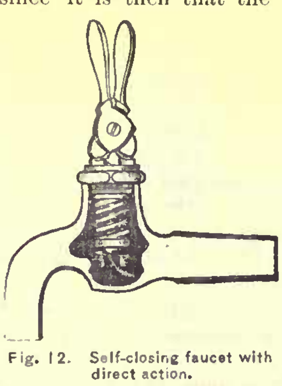


Fig. 12. Self-closing faucet with direct action.

Self-closing faucets may, like the hand-closing work, be divided into two kinds, namely, "direct," where the valve is opened by a spring or lever to which manual force is directly applied, and "indirect," where this is done indirectly as through an auxiliary valve. The former, with spring action, are objectionable in the same way as are ground faucets, on account of the water-hammer, due to the sudden movement of the spring.

Figure 12 represents one of the best and most popular forms of self-closing cocks, with direct spring action. The ingenious arrangement of the "double lever" furnishes the easiest means of overcoming the resistance of the spring.

Fig. 13 illustrates clearly the principle of the lever construction which forms the distinguishing feature of this particular device. In its usual form the upright rod between the levers, with its cross-bar, is omitted, as shown in Fig. 10, and the valve is raised by simply pressing the two lever-arms together with the hand. The upright rod is applied where it is desired to operate the valves by a vertical movement of the hand as in the case of some forms of water-closet supply. The drawings are so clear that nothing further is required to thoroughly explain the device.

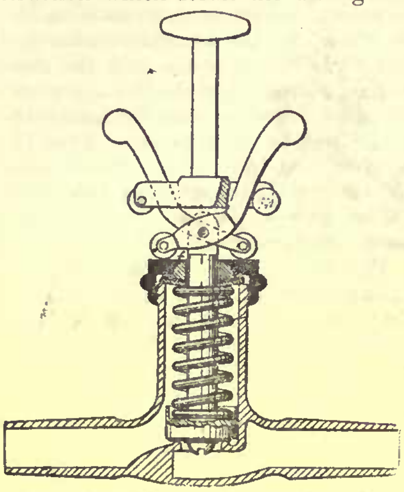


Fig. 13. Section showing the principle of the lever section.

In Fig. 14 a single lever is used in combination with a stationary arm serving as a hand-rest. This form is characterized by a swinging connection or joint between the lever and the valve stem permitting of the raising of the latter with a minimum of friction, and by the use of the rigid arm or finger-rest below so arranged that both the lever and the finger-rest may be grasped by the hand.

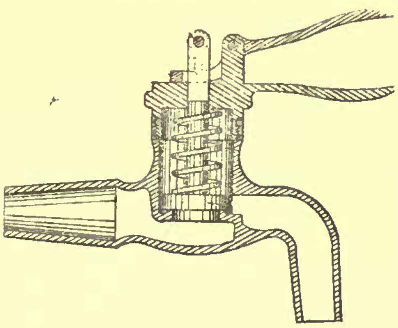


Fig. 14. Self-closing faucet, with single lever and swinging joint.

In Fig. 15 still another form of lever for compressing the spring has been adopted. In this apparatus the form and operation of the handle are like that of an ordinary screw non self-closing compression faucet, in that it is turned about its own axis. In so turning one of two lugs, which is shown between the two discs in Fig. 16, acts as a lever-end bearing against the cross-bar shown at the top of the valve-handle in Fig. 15, thereby raising the valve. In whichever direction the handle is turned, one of the two lugs presses up the cross-bar and its valve. The two lugs are shown also in Fig. 15 in section, of triangular form, under the cross-bar.

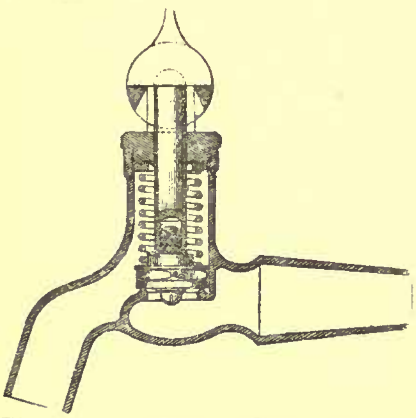


Fig. 15. Self-closing cock, operated by turning a key or handle on its own axis

This method of compressing the spring by turning a key or handle on its own axis requires, for an equal spring resistance, greater manual effort than the others on account of the shortness of the leverage usually attained therein. Unless the cross-bar forming the handle is of unusual length, giving the faucet an awkward appearance, the short and long arms of the lever are too nearly alike to render the operation easy except for the strongest hands.

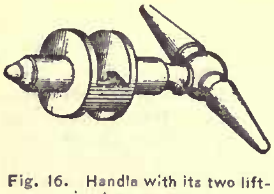


Fig. 16. Handle with its two lifting lugs or ears.

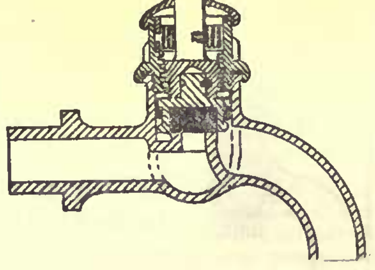


Fig. 17. Self-closing fau et, with threaded stem and volute spring.

In Fig. 17 is illustrated a type of self-closing cocks, in which a volute instead of a spiral spring is used with a threaded handle-rod. The valve revolves loosely in a socket in the handle-rod, to prevent abrasion of its cushion. Rattling is prevented by a small pin on the handle-rod which engages in an annular groove or slot around the small upper extension, or spindle, of the valve. The external threading at the bottom of the handle-rod causes it to rise or fall by its revolution in one direction or the other.

The volute spring has one of its ends secured to the handle-rod, and the other to the outer case or casting, and causes the rod to turn back and close the valve automatically after it has been released. The pitch of the threading regulates the speed of the closing.

Evidently, this construction is objectionable and unreliable both on account of the great amount of friction on the threading, and on account of its general complication. It has very little durability. The volute spring is too feeble to properly perform its functions under heavy pressure as it is here constructed.

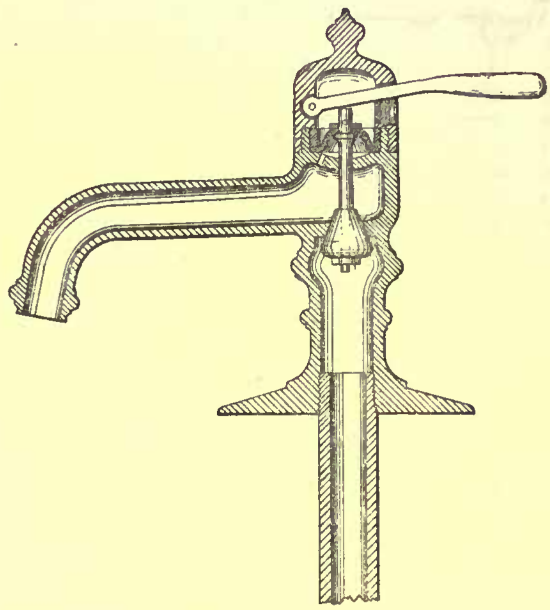


Fig. 18. Self-closing faucet with rubber spring.

In Fig. 18 a rubber spring is used. The spring serves also as a packing to prevent leakage round the valve-rod. The form of lever shown best illustrates the principle of the valve, but is not the one used. It has ample power, but an uncouth appearance, besides leaving an aperture in the casing for its play, through which dust enters the working parts and mischievous persons are tempted to push obstructions. As the faucet is usually constructed, a different form of lever not having this objection is used, in which the handle is made after the principle of a thumb-nut minus the screw-thread, operating with a rotary movement, and having two inclined cams working on corresponding cams fixed on the body of the faucet to effect the opening of the valve. Its closing is effected by the elasticity of the inverted cup-shaped rubber diaphragm forming the spring, whose speed of movement is regulated by the size of the small vent-hole directly underneath. The sample tested by the writer works very easily and without hammer under heavy pressure.

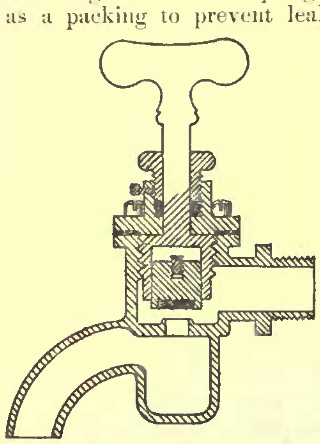


Fig 19. Self-closing feucet with loose plunger.

Fig. 19 represents a self-closing faucet, in which gravity is employed instead of tension, to close the valve. The valve-cushion is fixed upon the bottom of a free-moving plunger, loosely sliding in a cylindrical cavity in the lower end of the valve-rod. The valve-rod is threaded and moves up and down like that of an ordinary screw-down compression-cock. When the rod is raised the plunger follows through suction, but gradually falls under the influence of its gravity, the rapidity

of its motion being governed by the closeness of its fit in its socket or cavity, and by the small regulating screw on its upper surface, which limits more or less its upward movement.

SELF-CLOSING FAUCETS WITH INDIRECT ACTION.

We now come to the indirect principle of action in self-closing work. The main valve is actuated not directly by the handle-rod, but indirectly through the agency of a small auxiliary, trip, or relief valve. The small valve is opened by the handle-rod, and closed by a spring. The opening of the small valve relieves the upper surface of the main valve of its water-pressure, and causes it to rise in the same manner with that described in Figure 11. The closure of the small valve by the rubber spring forming the packing at the top of the faucet, causes the water-pressure to gradually accumulate again above the main valve, and slowly close it. The speed of closure is governed by the looseness of the fit of the plunger forming the body of the main valve in the cylinder in which it works, and by the small regulating-screw on its upper surface, which, as in the last described appliance, limits more or less its upward movement.

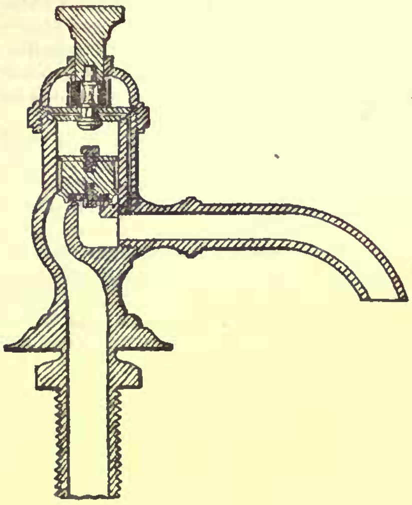


Fig. 20. Self-closing faucet, with small auxiliary valve.

Fig. 21 shows a pressure-relieving valve constructed on the same principle with the last described, except that the small valve is operated by the pressure of water in the pipes rather than by the hand. When the water-pressure reaches a certain amount, it lifts the weighted stem of the small valve by pressing on the elastic diaphragm at the top of the faucet, until the pressure overcomes the weight on the stem. This opens indirectly the main valve, until the pressure is relieved and the action is reversed.

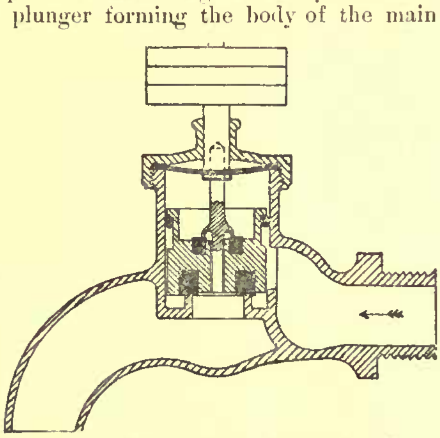


Fig. 21. Pressure relieving self-closing valve.

J. P. PUTNAM.

[To be continued.]

A CARPENTER'S PLUMBING. — Lake Geneva, is a lovely resort in Wisconsin, liberally patronized by wealthy Chicago people and others, who have built pleasant summer cottages and enjoy themselves as much as they can away from home. One of Chicago's brainiest plumbers was at this charming place recently and was sought out at the hotel by a local carpenter and requested to look over a job of plumbing, which the local shover of the plane had just finished in one of the best residences of the place. The plumber's fears were immediately aroused that he should see some plumbing wonderfully and fearfully made, but his worst fears could not forecast the surprise that awaited him. The carpenter, true to the idea which made the old shoemaker exclaim "There is nothing like leather," had constructed his soil-pipe of wooden pump-logs having a four-inch bore. The water-closet had a lead trap under it right enough, but the end of the lead pipe had been rimmed out so as to make a flange, which was nailed to the pump-log so as to connect with a hole through its side! From the bath-tub a straight lead pipe connected with the wooden soil-pipe through an augur hole through its side, the carpenter, evidently, realizing that while it was highly important to have a trap under the closet, it was not at all necessary to have one under the bath-tub. The wooden soil-pipe was continued to the basement where it entered a square-box drain leading to a wooden cesspool not far away.—*Sanitary News.*

PARIS GOSSIP.

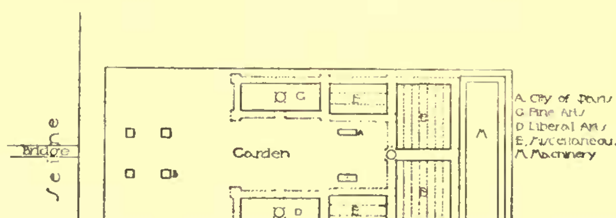
I WISH first of all to make good an omission from my last letter, and bear testimony to the emotion caused at the École des Beaux-Arts, and among all of us who have studied there, by the generous gift of our old American comrades. We have always had for you, we Frenchmen, the sentiments of real sympathy, and you have left among us at the atelier many charming recollections of good comradeship. The subscription that you have opened for founding at the École the *Prix de Reconnaissance des Architectes Américains* only knits closer than ever those bonds of friendship and sympathy which, in spite of the great distance which separates us, make us forever, heart and soul, your friends. In the name of all my French comrades, thanks.

I am going to speak to-day of the works of the Univeral Exhibition of 1889, and of the Concours de Rome, which has just been decided at the École des Beaux-Arts.

The workshops of the Universal Exhibition are in full swing; everybody is at work on the spot, and in the offices drawings are accumulating and the studies of details are being finished.

First, a word as to those who direct and organize the Exhibition. The director-general is M. Alphand, Director of Public Works in Paris and Inspector-General des Ponts et Chaussées. The Exhibition is divided into three groups. First, the fine arts and the liberal arts, of which the architect is M. J. Formigé; second, the miscellaneous group, of which M. J. Bouvard is the architect; third, the machinery building, at the head of which is M. F. Dutert, architect. The director-general in charge is M. G. Berger; and M. Paul Sédille, architect, will be employed in installing the French and foreign exhibits.

The Exhibition of 1889 will take place, as have former ones, upon the Champ de Mars, connected with the Trocodéro by the Pont de Jéna. The agricultural exhibition and the exhibits of the colonies will extend along the quays as far as the Invalides. As the sketch of the block-plan shows, an effort has specially been made to give to the gardens and the portions devoted to amusements as large an area



as possible. These have been made the centre of the Exhibition, and it is about these gardens that have been grouped the buildings of the Exhibition, properly so-called. These buildings almost cover the entire surface of the Champ de Mars, leaving between them and the exterior avenues only a space of no great importance. Opposite the Military School, and running the full width of the Champ de Mars, is the machinery gallery, of which the metallic trusses have a span of one hundred and fifteen metres. At this moment they are building the foundations of this gallery, and the contract for the iron has just been awarded. After the machinery gallery comes the miscellaneous group, that is to say, the exhibition

of products of all kinds. This part of the Exhibition has the shape of an immense rectangular horseshoe. It is composed of twenty bays, which are arranged as the sketch shows. The fourteen parallel bays of the machinery gallery are separated by a central passageway. The span of the trusses is twenty-five metres. The central motive of the façade that looks on the garden — the real façade of the Exhibition — will be a dome sixty metres high, all of iron, and enriched with decorative features, stained-windows, tile-work and terra-cotta. On each side of the dome will extend porticos, which surround the whole Exhibition. Under these porticos, which are fifteen metres wide, will be the cafés, restaurants, etc. These porticos will also surround the two pavilions of the fine arts and the liberal arts, which are found in the prolongation of the two wings of the miscellaneous group. These two pavilions, very richly treated, will be crowned by two domes, decorated with enamel, upon the decoration of which much of the success of the Exhibition is thought to depend. The city of Paris will have its pavilion in the garden at "A," opposite another pavilion of similar character.

The somewhat heavy-looking trusses of the miscellaneous group are already in place, and the foundation of the pavilions of the fine arts and the liberal arts are also laid. One can now appreciate the good points of the general plan. The idea of making the garden, where will be found all kinds of distractions and amusements, the central feature of the Exhibition is excellent. It will not be necessary, as in the Exhibition of 1878, for a person at one end of the building to pass through all the buildings to reach the gardens, which in that Exhibition were scattered in several places.

The Eiffel three-hundred-metre tower also progresses. It is on the bank of the Seine on the axis of the Pont de Jéna. It will form on this side a monumental entrance to the Exhibition. As you already know, the tower is borne by four metallic arches, which rest normally upon four masonry piers. For the two piers which are farthest removed from the Seine a solid foundation has been found at the depth of seven or eight metres, but for the two nearest the Seine the difficulties have been more serious, and a solid bearing has only been reached after having excavated to great depth through courses of wet sand. The square formed by the four piers is about one hundred metres on each side; each pier is twenty-six metres square, but is not formed of a solid mass of masonry. The engineers have been satisfied with offering a solid point of support to each of the four arched ribs which form the caisson of each metallic arch. The surface of these four points of support is obliquely inclined, so that the arches rest upon them perpendicularly. Two strong bolts, fifteen centimetres in diameter, are fixed through each of the points of support, and lying in the same vertical plane they serve to preserve the equilibrium during the raising of the arches, which are built out of perpendicular [*en porte à faux*]. M. Eiffel has built the arch to the height of twenty-five metres without the use of any other point of support. Once the arches erected, these bolts will have no real effect, the tower owing its stability to itself and its own weight. In one of the piers is the elevator. The foundations are laid, and the iron arches begin to rise and approach one another. When one sees the work going on at the site of the tower one is astonished at the magnitude of this enterprise. I cannot guess the effect which the tower will produce from an artistic point of view. It is surely a gigantic structure, most interesting for all of us to follow during construction, and if its usefulness is not yet absolutely demonstrated, it will have unquestionably a grand *succès de curiosité*. The construction, if we may judge by the part that is begun, is very bold, and the iron arches are very light in appearance.



Plan



Section

Such is the present condition of the works at the Exhibition grounds. They will make progress now with great rapidity, and I will keep you posted on everything of interest that takes place there.

The competition for the Prix de Rome has just been decided at the École des Beaux-Arts. Let me remark first, the success of the competition in painting. This year it was very good. The subject was this: "Themistocles, exiled from Athens, sought an asylum with the king of the Persians, Artaxerxes I, who showed him magnificent hospitality, and who tried to make him bear arms against the Greeks. In order to avoid obedience, Themistocles, in the midst of his family, drank poison, exclaiming, 'Behold the last sacrifice that I make for my country.'" The subject, you see, was quite interesting and lent itself to a very artistic interpretation. Surely, in it could be sought, besides the composition and arrangement of the painting, the expression of a lofty sentiment of patriotism on the part of the chief figure. It is in this last particular that the ten competitors have failed, with the exception of one who carried off the Grand Prize.

Among the competitors were five pupils of M. Cabanel, — MM. Bastet, Sinibaldi, Lavalley, Jouve and Tollet; three pupils of MM. Bouguereau and Robert Fleury, — MM. Charpentier, Marioton and Lenoir. MM. Boulanger and Fabre had one pupil, — M. Boufet. And finally, the prize-winner came from the studio of MM. Gerôme and Millet. This was M. Henri Danger. His painting was surely superior to all the others.

Themistocles standing alone in the foreground of the picture, holds in one hand the cup of poison, with the other he gives a last hand-grasp to one of his grieving friends. Themistocles turns his back on his friends, not wishing to share their sorrow. The physiognomical expression is profound and dramatic without being theatrical. This man, we feel, is about to die. There is abundance of sentiment and emotion here. M. Danger is the only one who has succeeded in rendering truthfully this most human characteristic. Themistocles is clothed in perfectly-rendered and very clinging white drapery which covers his entire body and is wrapped about his head. M. Danger perhaps in this way wished to escape the difficulties of the nude; but, nevertheless, his composition is good, and we find ourselves face to face with an artist who has fairly won his Grand Prize

The First Second Grand Prize has been awarded to M. Jean Marioton for a good composition, luminous in tone and well modelled. Themistocles seated, his body bare, and holding a cup in his hand, is well drawn and rendered; but no one feels that emotion which he experienced a moment ago. It is correct, but cold.

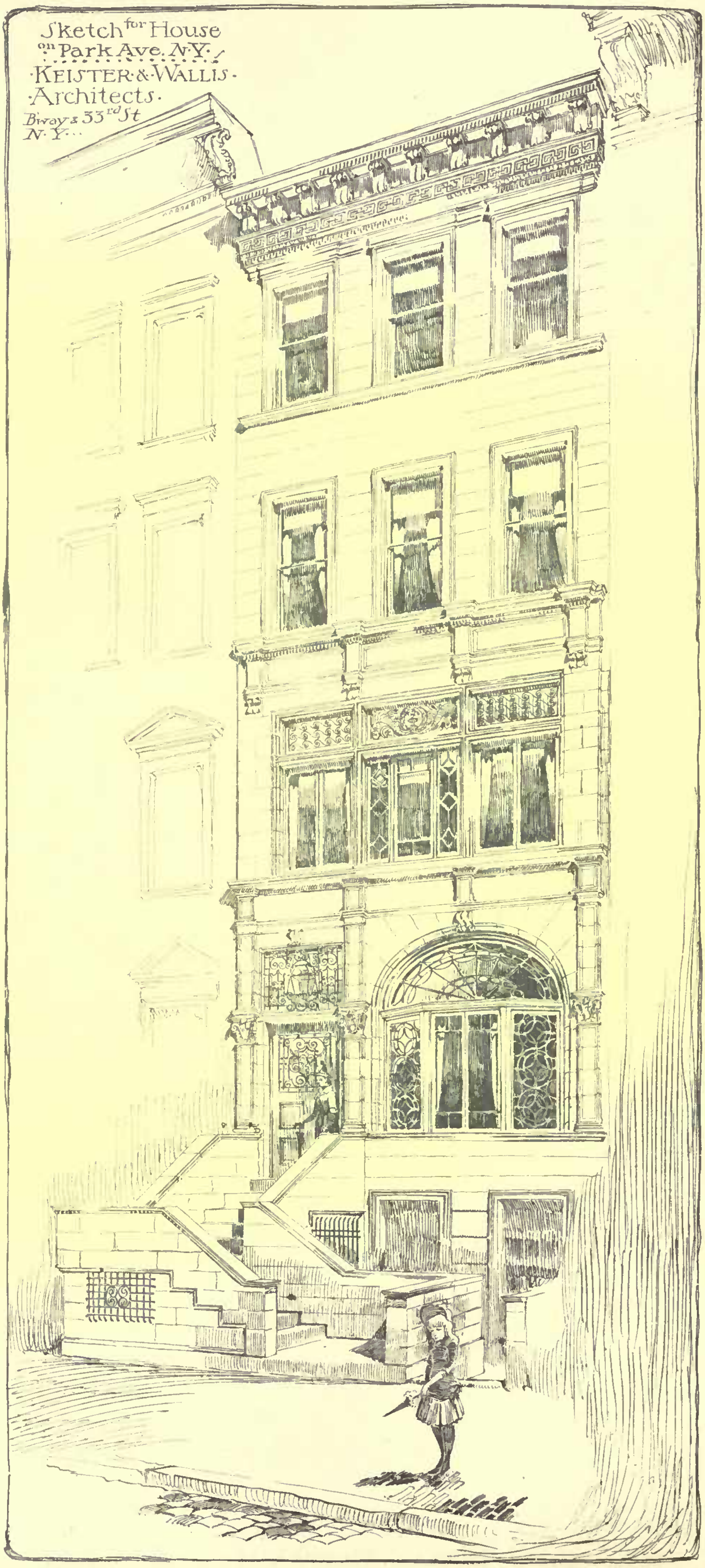
The same might be said of the Second Second Grand Prize gained by M. Charpentier, pupil of the same masters. It is almost too well composed, yet it is not absolutely theatrical, and has some characteristics of human nature about it, but it smacks more of the School and Academy. The other candidates in whose work we find many good qualities of drawing and rendering (I mention among others M. Sinibaldi's, which is distinguished by a charming bit, a nude female, seen from behind) almost all gave to the principal figure a pretentious and affected attitude. In spite of this, the competition was better than that of last year, and we may hope that these young artists will later give us more interesting work from every point of view.

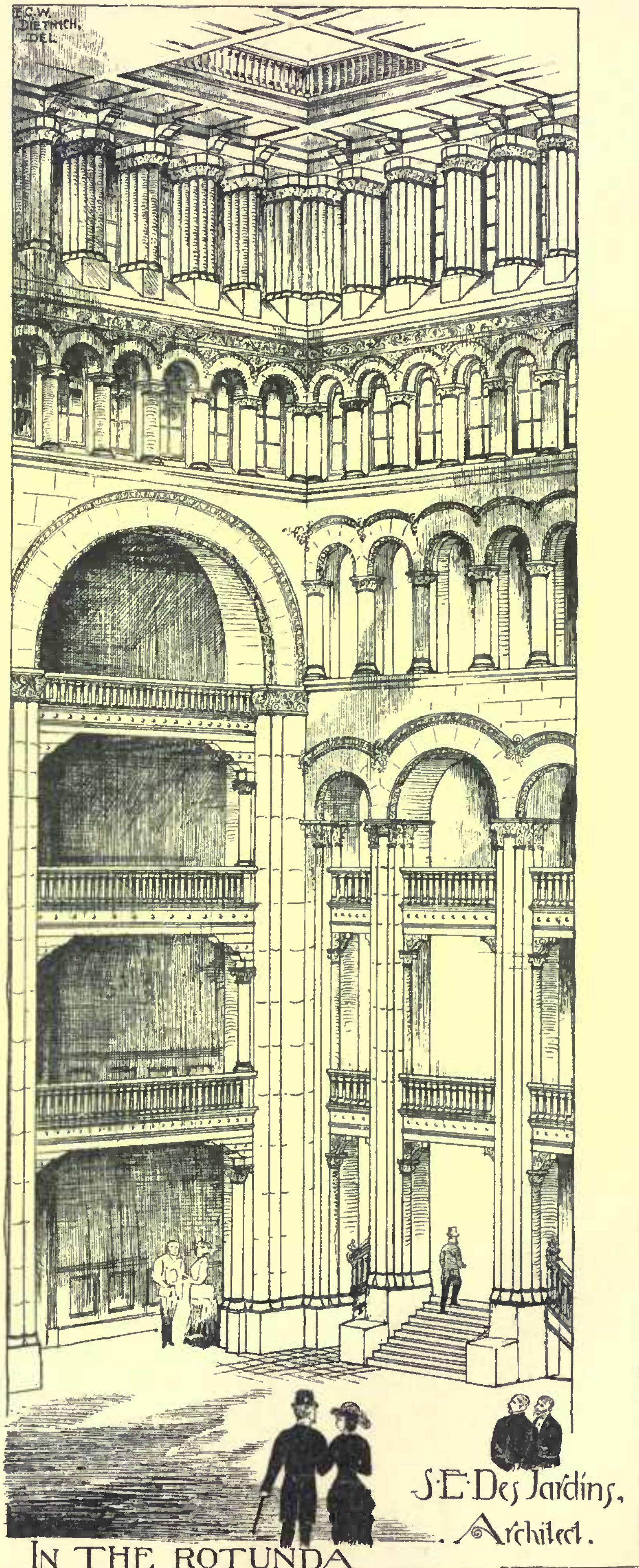
The competition in sculpture was, on the other hand, very inferior to its predecessors. The competitors had to treat in bas-relief the following subject: "Creon, having abducted the two daughters of Œdipus, exiled and blind, Theseus delivers them and restores them to their father. Œdipus stretches out his arms to them, calling on them to approach that he may press them to his heart." All the subjects exhibited were absolutely wanting in feeling, and for the most part the figures were also lacking in proportion — limbs either too frail or too massive, — giants or dwarfs. All this was not satisfactory. M. Jean Desvergnes, pupil of MM. Thomas and Chapu, nevertheless distinguished himself by a better composition and a better arrangement of his figures, and a very graceful disposition of draperies, which were supple and well rendered. I no not know why M. Desvergnes only received a First Second Grand Prize. The first prize was carried off by M. Edgar Boutry, pupil of M. Cavelier. The Second Second Grand Prize was won by M. Jean Soulès, pupil of MM. Jouffroy and Falguières. I will not say anything of their very ordinary performances, except that they had worked hard upon them.

And now for architecture, and the large frames which cover the walls of the Hall of Melpomene, a work which is enormous so far as dimensions and also study are concerned, but which is only of slight interest to the ordinary public. It must be confessed that a certain amount of education is needed to judge and appreciate these efforts of our young comrades. The competition this year was unfortunately classic, and, given the system of the École des Beaux-Arts, offered few excuses for new ideas or novel expressions. This time we do not get out of the realm of mere typical plans, and the model façades which we so well know in the atelier.

The ten competitors admitted to the final proof were, in the order of their admission, MM. Tournaire, pupil of M. André; Chedanne, pupil of M. Gaudet; Lafon, pupil of M. André; Bertone, pupil of M. Ginain; Sortais, pupil of MM. Daumet and Girault; Eustache, pupil of M. Ginain; G. Cousin, pupil of MM. Coquart and Gerhardt; Heublès, pupil of M. Pascal; Raphel, pupil of M. Raulin; Lacoste, pupil of M. Ginain. The programme was a gymnasium: "This establishment, near a large city and a park, must testify through its monumental conception to the wealth of the municipality which built it. It must be composed first, of a hall for reunions and conferences; second, of a gymnasium; third, a natatorium; fourth, a tennis-court; fifth, a running-track for foot-races and athletic contests. These divisions must be preceded by a vast vestibule, with the ticket-offices and the rooms of the officers; a *porte-cochère* for carriages, a pavilion for the administration, and apartments for the director and the *personnel* of the establishment; a grand restaurant, with café and smoking-room must be placed so as to be accessible to the people who make use of the gymnasium." Such are the chief lines of the programme. Each division had to be accompanied, according to its intended use, with vestibules, porticos, closets, galleries for artists and professors, halls for rest, etc.

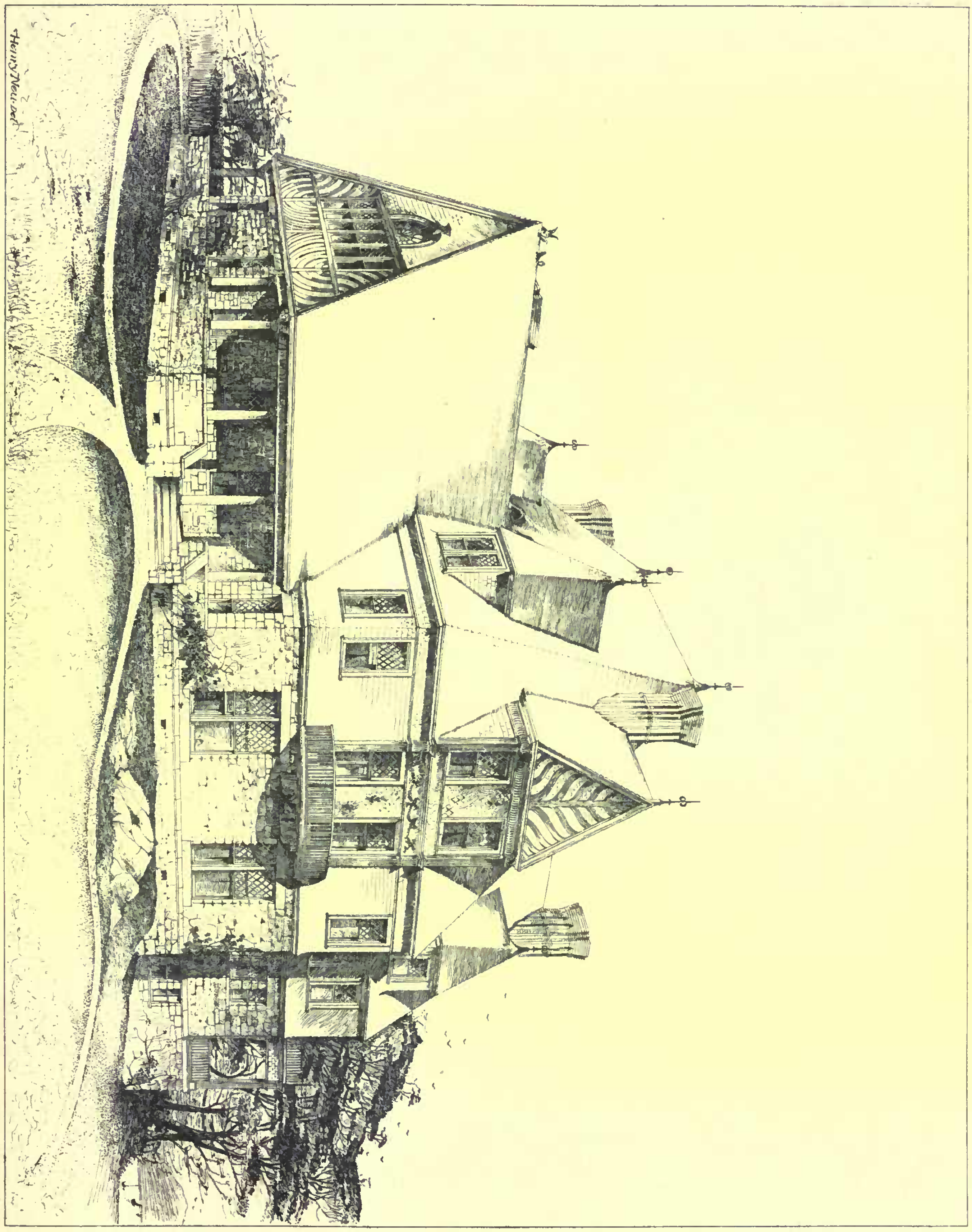
M. Georges Chedanne carried off the First Grand Prize. His plan was good, well understood, and compactly grouped. The entrance was distinguished by a large portico, whose central motive was a triumphal arch. On passing this portico, entrance was had into a vast court-yard, on the left of which was the natatorium, preceded by a large vestibule. On the right was the gymnasium. Perhaps these two divisions were not sufficiently studied. The natatorium was ornamented by a rotunda, and enlarged at its two ends by curved parts, which were not repeated in the gymnasium. At the back of this large court-yard, surrounded by a portico, M. Chedanne had grouped the three divisions which were more especially intended for the public, in that they offered the chance of exhibition; the tennis-court at the left, the hall for reunions and concerts on the right, and at the back a large apartment for racing, these three divisions having a common entrance through a large and grand vestibule. The restaurant was somewhat sacrificed to the lower story, and was placed in the first story, forming there a loggia. The façade was


Sketch for House
on Park Ave. N.Y.
KEISTER & WALLIS
Architects
B'way & 33rd St
N.Y.

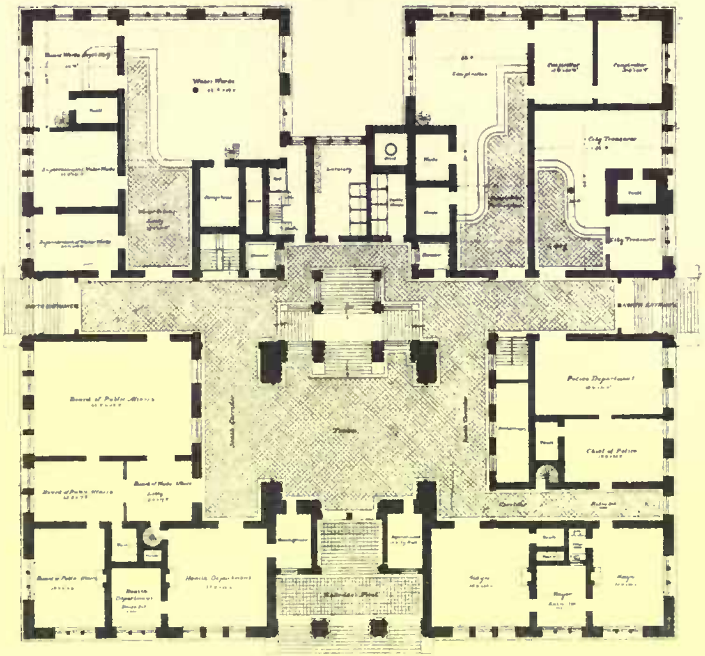


IN THE ROTUNDA

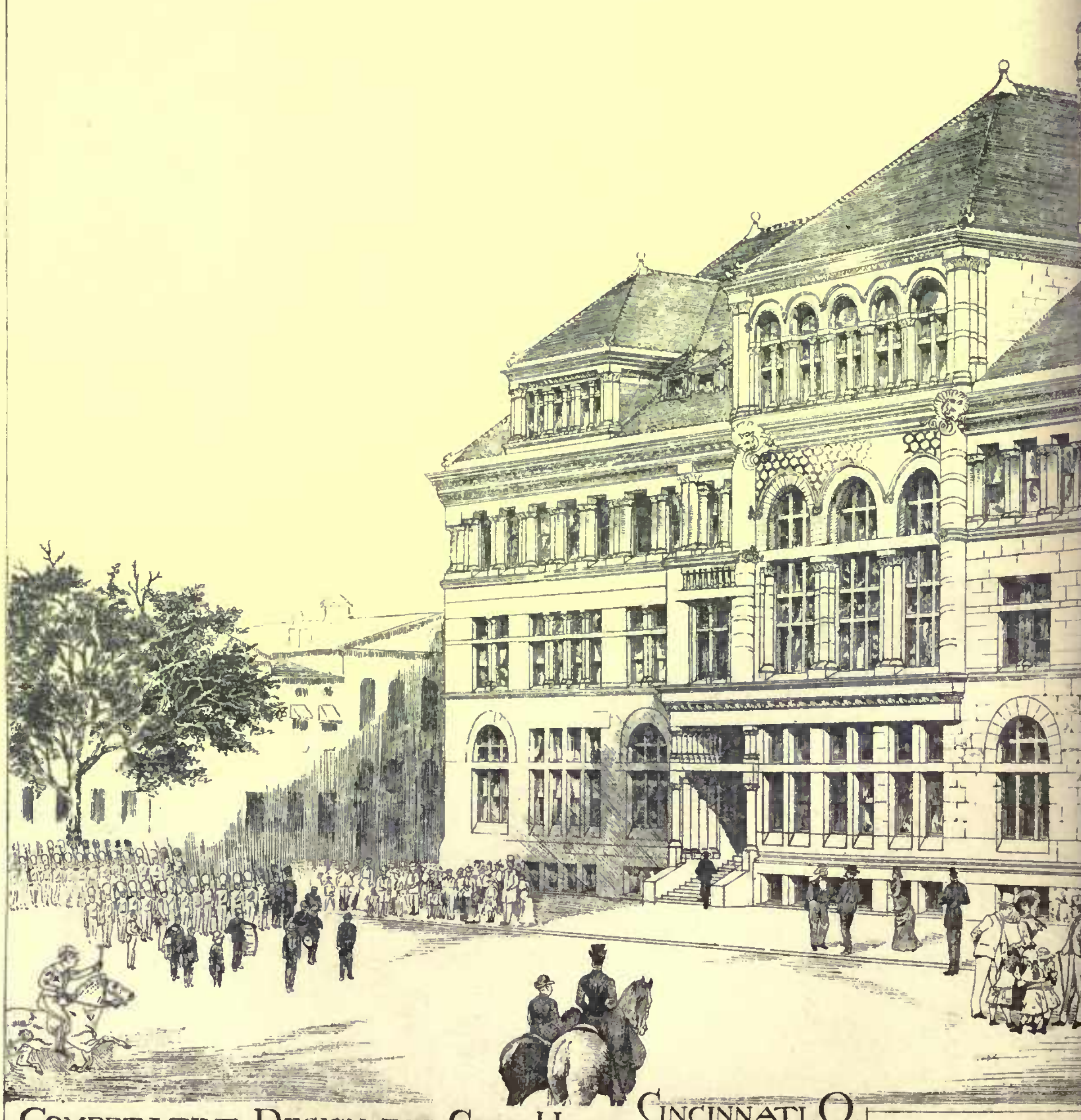
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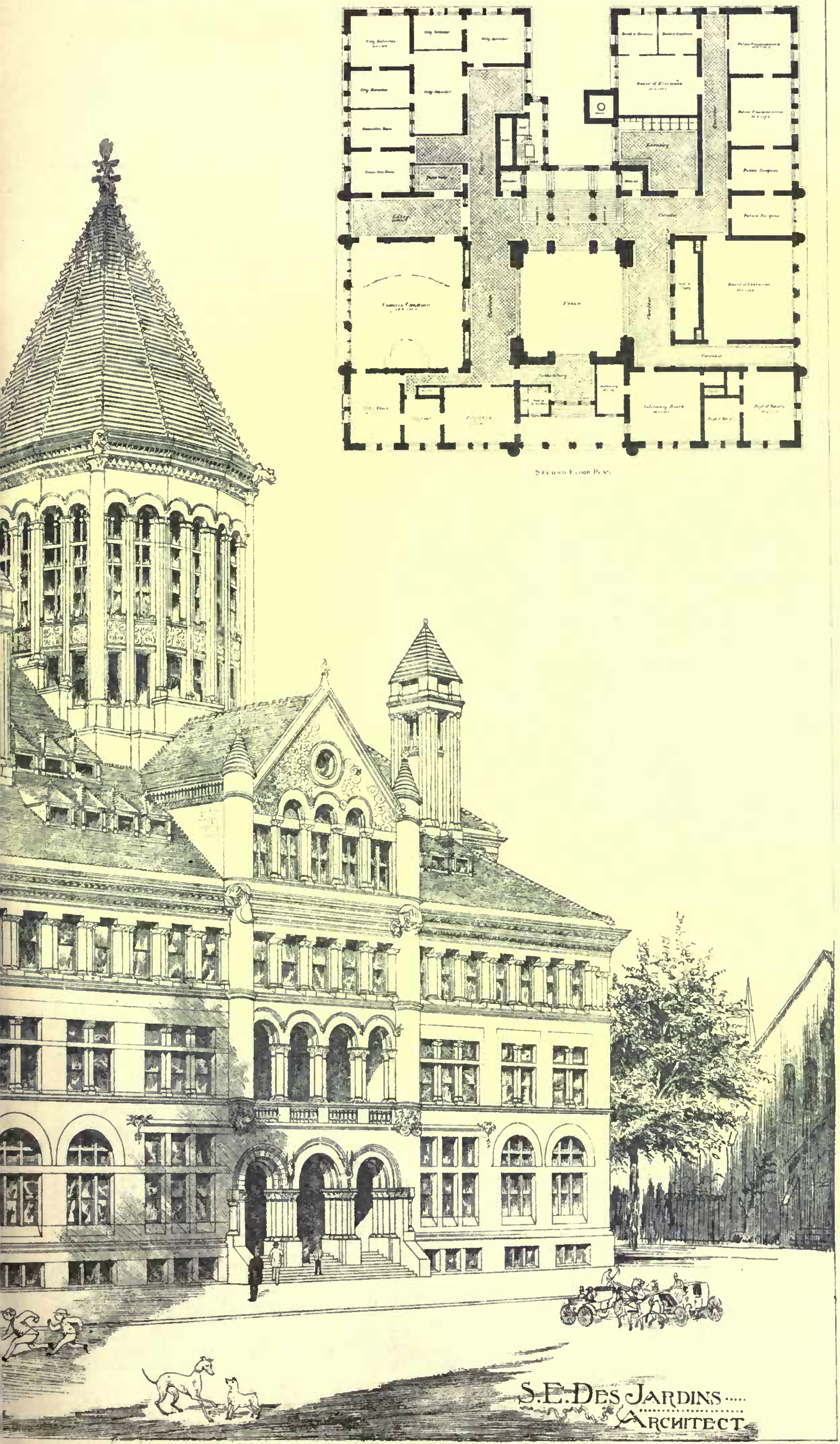
Heliotype Printing Co. Boston



FIRST FLOOR PLAN



COMPETITIVE DESIGN FOR CITY HALL CINCINNATI, O.



SECOND FLOOR PLAN.

Heliotype Printing Co. Boston



Doorway of Church at Harfleur, France.

somewhat complicated. The triumphal-arch was thoroughly commonplace. The porticos which accompanied it were classic. It was plain that something else should have been sought for, but M. Chedanne was, perhaps, right in sticking to the key-note he had selected. It does not pay to show too much originality in a struggle for the Grand Prize. His façade had, moreover, a good silhouette.

The First Second Grand Prize was awarded to M. Henri Eustache. His plan was compact. The entrance to the hall of reunion, the tennis-court, and the natatorium was easy, but the race-track at the rear was shut in by the gymnasium, and ill-arranged for access. The façade was classic, and had no silhouette. There were, to be sure, large porticos of good proportions, but everything was antique. In fact, it was a mere school *projet*.

M. Charles Heublès won the Second Second Grand Prize. His plan was quite attractive; nevertheless, the entrance, in spite of its width, was obstructed by points of support of too great magnitude; his race-track was too far off and too isolated. He sought circular arrangements and complicated forms, whose real purposes were not clearly indicated. His façade was interesting, in spite of its poor proportion. Silhouette was not lacking, but the rendering was disagreeable, and did injustice to the composition.

It was a pity indeed that M. G. Cousin received nothing. He had a charming plan, well arranged and well studied. Unfortunately, it was too pretty, too refined, too delicate. Evidently it did not have the amplitude and proportions demanded by the programme. All the same, it was a very pretty study.

M. Tournaire, who last year won the First Second Grand Prize, was nowhere this year. His plan was well presented, but badly constructed; all the parts were scattered. The gymnasium, which was large — too large — completely stopped up the approach to the natatorium and the hall of reunion, and this last was entirely isolated at the back of the building. His façade, on the other hand, was very fair, well studied, and well rendered. M. Tournaire sought something a little more original than his comrades. Unfortunately, the exaggerated importance given to the gymnasium was apparent in the façade, and made a long low line without silhouette. In fine, the competition was good, but interpreted in a commonplace fashion without evidence of personality.

I will close with mentioning the appointment of M. Th. Deck, the well-known *ceramiste*, to the post of director of manufacture at Sèvres, in place of M. Lauth, discharged. M. BRINCOURT.

THE ILLUSTRATIONS

[*Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.*]

THE CHANNING UNITARIAN CHURCH, NEWTON, MASS. MR. G. F. MEACHAM, ARCHITECT, BOSTON, MASS.

[Gelatine Print, issued only with the Imperial Edition.]

COMPETITIVE DESIGN FOR THE CITY-HALL, CINCINNATI, O. MR. S. E. DES JARDINS, ARCHITECT, CINCINNATI, O.

HOUSE FOR PIERRE LORILLARD, ESQ., TUXEDO PARK, N. Y. MR. JOHN BROWN LORD, ARCHITECT, NEW YORK, N. Y.

SKETCH FOR HOUSE ON PARK AVENUE, NEW YORK, N. Y. MESSRS. KEISTER & WALLIS, ARCHITECTS, NEW YORK, N. Y.

DOORWAY OF THE CHURCH AT HARFLEUR, FRANCE.

BUILDING MATERIALS.[1] — III.

THE materials that come under the designation of stone as used for building purposes, consist either of the rocks belonging to the earlier geological formations (such as the various descriptions of granite,) or of deposits that are the result of the decomposition of such formations as represented by those that are of a sedimentary character. These sedimentary rocks may be classed under two heads, sandstones and limestones, some of them partaking of the nature of both, such as the Mansfield redstone, which is a siliceous magnesian limestone.

Of the sandstones there are a great variety, some of them being of too hard and too coarse a texture to be available for buildings the character of which necessarily entails a considerable amount of ornamental work, but they afford excellent material for plain heavy masonry, where strength and durability are the main points to be considered. We have examples of such material in the gray sandstones of Dundee and Arbroath, which have been much used for paving in Edinburgh and Glasgow, and of the coarser varieties in that which is known as Bramley Fall stone, used for Kirkstall Abbey, built in the 12th century, the name being derived from the quarry in the neighborhood of Leeds, whence this description of stone was first obtained. This quarry has been closed for some time, but the original name is retained, and now represents a quartzose sandstone, varying considerably in its texture, belonging to the millstone-grit formation, and obtainable in very large blocks from a number of quarries in Yorkshire, Lancashire, and Derbyshire. It is chiefly used for engineering works, such as engine-beds, dock-walls, and foundations, being especially adapted for massive work of every description where large blocks are required.

The finer descriptions of sandstone come under the designation of "freestone," a term that has no very distinctive meaning, but one which is commonly employed when speaking of any stone, whether it be a sandstone or a limestone, that is capable of being easily tooled, quite irrespective of its chemical composition. There is an ample supply of excellent sandstone for general building purposes both in England and Scotland. In England this is especially the case as regards the counties of Lancashire, Yorkshire, and Derbyshire, in which there are a number of quarries yielding a very durable material, which is, at the same time, sufficiently soft to admit of being easily worked with a chisel.

The stone from the Darley Dale and Knabb quarries, in Derbyshire, has been largely used in Manchester, and it would not be easy to find a better test of the durability of stone than subjecting it to the influence of such an atmosphere as that of the city of Manchester. The New Stanton and Coxbench quarries yield an excellent material for building purposes, some of the stone from New Stanton being also suitable for grindstones.

Of the Yorkshire sandstones, amongst those that have been longest known may be mentioned the Hare Hills and Park Spring stone, which have been extensively employed for many years in London and in various parts of the country.

The Scotgate Ash quarries, near Pately Bridge, yield an excellent building stone, some of the beds affording a material suitable for landings. A fine grained sandstone is obtained near Sheffield, which has few rivals as regards its properties as a grindstone, and in the district which lies between Bradford and Halifax are obtained in large quantities the flagstones for which Yorkshire possesses such a high reputation. The red Corsehill stone from Annan, in Dumfries, is one of the finest of our red building stones. It is uniform in its texture, of a rich deep red color, which is but little liable to alteration. This stone is peculiarly adapted for use in conjunction with bricks or terra-cotta, and has been employed with good effect for several buildings in London and its neighborhood.

One of the finest sandstones is that known as the Craigleith stone, which has been very extensively used in Edinburgh. It is a close-grained compact stone, consisting almost entirely of silica, the particles of quartz sand being bound together by a siliceous cement, the total quantity of silica it contains, as shown by analysis, amounting to ninety-eight per cent. The permanent character of this stone has been thoroughly established; exposure to the weather for 200 years having in some cases scarcely produced any effect upon it, but it is questionable, however, whether the stone now obtainable under this name possesses the excellent properties of the original supplies. The Minera stone from near Wrexham, in Denbighshire, has been largely used in Liverpool and Manchester, and was employed in London for the building near the Mansion House occupied by the National Safe Deposit Company.

At Grinshill, near Shrewsbury, there are quarries which yield a fine-grained building stone, of which there are three varieties, white, yellow, and red, which has been extensively used in Liverpool, Manchester, and Birmingham, and towns in the midland counties, as well as in London. This stone was employed for many of the churches in Shropshire, including Battle Church, standing on Shrewsbury battlefield, and has proved to be a good weather stone.

The Prudham stone, from the neighborhood of Newcastle, has within the last two or three years been introduced into London, and from the condition of this stone, which was employed for buildings in Woolwich Dock-yard some forty years ago, it may (if obtained from the same beds) be expected to prove a durable stone.

Uniformity of texture is an important consideration, more especially as regards sandstones, inasmuch as some of this class contain portions differing in character from the mass of the stone, showing a tendency to weather at a different rate. Sometimes such portions are less liable to alter than the mass, and are thus left as excrescences, whilst in other cases they weather more rapidly, and the stone presents a more or less pitted appearance.

Limestones, as a class, are quite equal in importance to the sandstones as regards the number and variety of the beds yielding an excellent material for building purposes. They differ widely from each

[1] A lecture by W. Y. Dent, F.C.S., F.I.C., read before the Society of Arts, and published in the *Journal* of the Society. Continued from page 102, No. 609.

the quarry water. This beneficial result is not obtained when any process of artificial drying is adopted, which is too rapid to allow the matter deposited to assume such a crystalline structure as results from the slow drying effected by simply exposing it to air. Moreover, such artificial drying may have an injurious effect, on account of its giving rise to unequal expansion and contraction of the surface of the stone as compared with the moist interior.

[To be continued.]

BOOKS AND PAPERS

MR. PATER'S new volume, like his "*Marius the Epicurean*," will only please those persons who, as he himself says, can enter into the seriousness of life. They will find "*Imaginary Portraits*"[1] in its way as charming as "*Marius*," but it is, if possible, more sad. Mr. Pater has evidently found the world what it is to the generality of people unless they shut the eyes and ears of their understanding, an eminently sad place. But he might sometimes give us less dismal terminations. True, life ends in the change to all of us which we familiarly call death, and Mr. Pater believes fully in the sacrifice of one person for another — pure self-sacrifice. This, in these days of the selfish pursuit of ease and comfort, is most refreshing, but the ends of his four imaginary persons are almost too miserable. One dies of consumption; another is hunted to death by a mob, and torn bit from bit; the third is drowned in an inundation after having saved the life of an infant; and the fourth is crushed to death by a victorious army. But it is only with the first of these personages that we have to do, "a prince of court painters," Antoine Watteau.

Whether Mr. Pater has really found "an old French journal" giving details of Watteau's life, we know not, but it purports to be the diary of a girl who evidently loved the painter, and whose young brother, Jean Baptiste, becomes Watteau's pupil. This is no other than Jean Baptiste Pater, but whether an ancestor of the author's, or whether the sameness of name gave the idea for the sketch, we are left in ignorance. At any rate, the journal has all the local coloring which makes it appear a reality, and the various incidents in Watteau's commonplace life are welded together with much feeling. Mr. Pater has only one fault — he is too often obscure; his sentences are long, and the sense is often involved. This was the great fault of "*Marius*," and prevented many persons from reading a book which would have charmed them and comforted them, and the perusal of which would have been to their profit. "*Imaginary Portraits*" has fewer of these defects, but, as an example, on page 2 we have a sentence of fifteen lines out of twenty-five.

Watteau was the son of a stone-mason, and being a painter born and "genius," besides the godson of the elder Pater, who was a sculptor, he seems to have been helped on and encouraged by the older man. Little sympathy did he get as a boy from his father, although "he was not ill-to-do," for he had built him a new house in their native town, Valenciennes. In this old place he makes much progress, but the narrator's father thinks he has "too little self-approval of his work which he does so easily." All his days he seems to have been dissatisfied with his work and with his life. Was this due to his large, unquiet eyes, or were they agents of the unquiet brain? He "habitually fell out with himself and what he produced." At last his restlessness cannot be kept within bounds, and he goes to Paris, a result brought about by his girl friend speaking to a scene-painter from the great city, unknown, of course, to Watteau. And then there is a giving of farewell presents, the girl presenting him "with a silken purse she had long embroidered for another."

At Paris, Watteau became one of Metayer's assistants, and distinguished himself as able to paint any part of a subject, whereas, the other apprentices could only do a "*coiffure*, or a robe, or a hand." The pictures so concocted were sold on the Pont Nôtre-Dame at a low price, and for his work Watteau received three livres a day, but he soon gave this up, and took to decorative work, and, oddly enough, battle pictures; and then he returns home and lodges with the Paters, and fascinates Jean Baptiste as well as his sister with his art and his elegant manners and "his air of seemly thought." He takes the adornments of life "as if he had been born to them," and so Jean Baptiste goes back to Paris with his friend, and no longer "dances a minuet upon the grass with his youngest sister to the tune of a strolling lutanist." Is not this quite a Pater subject?

Later on we hear of Watteau competing for the *Prix de Rome*, but only gaining the second place, which prevented him from going to Rome. And then the girl remarks: "Could I save enough by careful economies for that purpose? It might be conveyed to him in some indirect way that would not offend." How charming this is! In 1712, the girl writes that they read in the *Gazette* that "Watteau had been elected to the Academy of Painting under the new title of *Peintre des Fêtes Galantes*, and had been made also *Peintre du Roi*. My brother, Jean Baptiste, ran to tell the news to old Jean Philippe d'Michelle Watteau." Then the painter became acquainted with the connoisseurs M. de Crozat, M. de Julienne, the abbé de la Roque, Count de Caylus, and M. Gersaint, who all of them wanted to lodge him in their fine hôtels. And thus the journal describes Watteau's new manner of decorating houses: "Something of lightness and coquetry, at variance, methinks, with his own singular gravity and even sadness of mein and mind, more answerable to the stately apparelling of the age of Henry the Fourth or of Lewis the Thirteenth, in these old, sombre Spanish houses of ours." And then when her brother goes to Paris, she cries from her inmost soul: "With how small a part of my whole life shall I be really living at Valenciennes." In March, 1714, she relates that she went to early mass in the church of St. Vaart, where "our people lie under one of the great marble slabs before the *jubé*," and where the settle which runs around the wide nave is her father's work. Here she once again meets Antoine, who has come to stay with the old people, and uses his holiday in painting the Pater's *salon* in the new *Watteau* style. "The rough plaster we used to cover, as well as might be, with morsels of old-figured arras-work, is replaced by dainty panelling of wood, with mimic columns, and a quite aerial scrollwork, around sunken spaces of a pale-rose stuff, and certain oval openings — two over the doors, opening on each side of the great couch which faces the windows, one over the chimney-piece, and one above the buffet which forms its *vis-à-vis* — four spaces in all, to be filled by and by with 'fantasies' of the Four Seasons, painted by his own hand. He will send us from Paris arm-chairs of a new pattern he has devised, suitably covered, and a painted *clavecin*. . . . He has completed the ovals — the Four Seasons. Oh! the summerlike grace, the freedom and softness of the 'Summer' — a hay-field such as we visited to-day, but boundless, and with touches of level Italian architecture in the hot, white, elusive distance, and wreaths of flowers, fairy hay-racks and the like, suspended from tree to tree, with that wonderful lightness which is one of the charms of his work. . . . I can understand through this, at last, what it is he enjoys, what he selects by preference from all that various world we pass our lives in. I am struck by the purity of the room he has refashioned for us — a sort of *moral* purity, yet in the *forms* and *colors* of things. Is the actual life of Paris, to which he will soon return, equally pure that it relishes this kind of thing so strongly?" Poor innocent Valenciennaise!

A few months later she writes — or rather her descendant, Mr. Walter Pater does, for the sentence is in his most poetic vein — "the sullenness of a long, wet day is yielding just now to an outburst of watery sunset, which strikes from the far horizon of this quiet world of ours, over fields and willow-woods, upon the shifty weather-vanes and long-pointed windows of the tower on the square — from which the *Angelus* is sounding — with a momentary promise of a fine night." Of her brother she says: "There are points in his painting (I apprehend this through his own persistently modest observations), at which he works out his purpose more excellently than Watteau, of whom he has trusted himself to speak at last, with a wonderful self-effacement, pointing out in each of those pictures, for the rest so just and true, how Antony would have managed this or that, and with what an easy superiority have done the thing better — done the impossible." Pater was a far more patient and hard worker than Watteau, painting from dawn to sunset and drawing afterwards by lamplight, but he was not so fine a colorist, and his work has the appearance of being more labored. Like his descendant, he is wanting in "style"; indeed, it is our author's only fault. Is it the remains of the somewhat clumsy and heavy disposition of the old Flemings?

Space will not permit me to quote all the paragraphs I have marked in the book, but in all Mr. Pater's criticisms of Watteau, Pater, Dow, and others who pass before the reader's eyes, he is more or less correct. That Watteau, like our own Reynolds and Wilkie, was a careless painter as regards pigments and combinations of colors is only too patent by his works which survive, but that his aspirations were much above those of his contemporaries is doubtful. Perhaps the following may be Watteau as seen through the spectacles of the girl who loved him: "Those trifling and pretty graces, the *insignia* to him of that nobler world of aspiration and idea, even now that he is aware, as I conceive, of their true littleness, bring back to him, by the power of association, all the old magical exhilaration of his dream — his dream of a better world than the real one." Perhaps, like others, he drifted into painting court ladies and gentlemen against his better self, and, to make them bearable, he put them into such surroundings as the "L'embarquement pour l'île de Cythère." But we cannot help wishing that his art had been more like his disposition — serious. That his pictures are charming idyls every one must admit, but one cannot help feeling that his people are clothed in the shams of the period, and full of the affectation of hilarity and the sylvan virtues. If only his splendid coloring, his nervous drawing, his grace and elegance could have been expended upon something better! For fans and *clavecins* and other small decorative work, his art is perfect, but I fancy most persons who feel the seriousness of life would get weary of sitting an entire day in a room panelled with *fêtes champêtres*. There is nothing so irritating as being told to be cheerful when one is melancholy, and nothing so wearisome, when the heart is sad, as to sit looking at others dancing.

Watteau died of consumption at thirty-seven years of age, having been more or less a victim of the disease all his life. Here are his love's reflections upon the end. "I think his days, too, would have been really happier had he remained obscure at Valenciennes" (and married me, one reads between the lines). "Our incomparable Watteau is no more! . . . Antony Watteau departed suddenly in

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[1] "*Imaginary Portraits*," by Walter Pater, M.A. Macmillan Co.: London and New York, 1887.

the arms of M. Gersaint on one of the late hot days of July. At the last moment he had been at work upon a crucifix for the good *curé* of Nogent, liking little the very rude one he possessed. He died with all the sentiments of religion. He has been a sick man all his life. He was always a seeker after something in the world that is there in no satisfying measure, or not at all." S. BEALE.

COMMUNICATIONS

THE FRENCH AND HOUDON'S "WASHINGTON."

TO THE EDITORS OF THE AMERICAN ARCHITECT:—

Dear Sirs,—In a recent number of the weekly supplement to the *Gazette des Beaux-Arts* I find the following article on Houdon's statue of Washington which I venture to translate in full. It is signed "L. G.," and may, therefore, be attributed without breach of etiquette to M. Louis Gonse, the editor-in-chief of the publication.

"M. Félix Régamey has just published in the literary supplement of the *Figaro* a most interesting article on one of the least well known yet most important works of our great sculptor Houdon. It refers to the full-length statue of Washington which Houdon executed in 1788 in answer to the wish of the General Assembly of Virginia, and which was placed, in 1796, in the Capitol at Richmond, where it still stands to-day, almost forgotten by the American people and certainly quite ignored by Frenchmen. M. Régamey happened to see it—it may almost be said to discover it—in 1881, and addressed a report to M. Antonin Proust, the then Minister of Fine Arts, suggesting that a plaster cast should be taken from it for the Trocadéro Museum. Now, we know that it is proposed to open a subscription in several of the large cities of the United States for the purpose of offering to France a statue of Washington as a return gift of gratitude for the Liberty Enlightening the World. The idea is to appeal for the purpose to one of the best sculptors of America. But M. Régamey, while appreciating the excellence of this intention, asks, with infinitely good reason, whether the proceeds of the subscription might not be used in a way which would respond much better to the intentions of the American nation and to the desires of France herself.

"After making his report to M. Proust, he discovered that there still exists in the possession of the family of the caster, Hubard, an original proof in bronze (of the Houdon statue) of the same size as the marble. This replica would be sold for the price of 40,000 francs. 'Why,' asks M. Régamey, 'should one not suggest to the Government of the United States the idea of applying the proceeds of the subscription to the purchase of this bronze of Houdon's Washington, that it might be offered to the Louvre Museum in the stead of a modern statue of quite uncertain (*aléatoire*) artistic value, which would simply be destined to ornament a Parisian square?'

"We hope with all our heart that M. Félix Régamey's idea may make its way, and that his appeal may be listened to on the other side of the Atlantic. If the American people wish to thank us for our gift by such an attention, they could find none more delicate or better calculated to touch our feelings."

May I make myself the mouthpiece of what I think will be the sentiment of all your readers, and say to M. Gonse that our feelings are touched by his suggestion and that we appreciate to the full the delicate manner of its expression? The French, we know, are graceful people and a courteous, how, then, can we suspect a Frenchman of bad manners? Our own cruder code is different. Here it is a precept of the nursery that a gift shall not be criticized in the ears of the giver, but perhaps in France it may be, and perhaps the possible reception of a gift may be publicly discussed. If a French child were to say: Is not this a delightful object? We made it ourselves and would like very much to have it and might buy it cheaply if we would, but we hear that Cousin Jonathan means to make us a present (as he very well might) in return for that nice one we gave him last Christmas. Why should we not suggest to him to give us this instead of that similar object he means to manufacture himself, and which will be of very uncertain value? If a French child were to say this and take measures for bringing its words to its cousin's ears, perhaps he would not be scolded for bad manners and greediness, but praised for his good taste in the matter of gifts and for his courtesy in trying to preserve his friend from the disgrace of making a present which would not really represent his intentions or (delicious thought!) thoroughly meet the desires of the recipient.

In truth, M. Gonse's little article seems to me one of the most amusing productions I ever read. Its *naïf* want of tact is as superb as though no such thing as a sense of humor existed in the world, and is displayed not more in the general idea that such a hint should be given than in the manner of its giving. What a delightful way it is of persuading us to donate the Houdon statue, that calm assuming that the value of an American statue cannot be counted upon! How characteristically French is the ignorance of conditions in another country shown by the thought that the Government will have the disposal of funds collected by popular subscription! And how curious the assumption that such subscriptions will be raised seems to us who know the history of the Bartholdi statue in this country! Perhaps some one has really proposed to set them on foot, though I had never heard of the fact till M. Gonse declared it. But it seems a singular thought that money may be obtained to make a thank-offering for a gift with regard to which it was difficult to get enough money to make its mere acceptance possible. The story of the building of the pedestal is not an encouraging sign that France will soon get from us a Washington in just the way M. Gonse seems to expect. Now that we have it we are to a certain degree grateful for the Liberty. It is a fine piece of suburban landscape decoration, though in no sense a great work of art; and its giving was doubtless in large part inspired by very friendly feelings though an unfortunate echo of *réclame* accompanies it. Have we not even heard that New York and the title "Liberty" were but second thoughts—that Suez and some such name as "Commerce," or "*La France Protectrice*," were at first associated with the artist's conception? But to speak thus is to be exasperated by M. Gonse's example into the very error against which I have protested. Indeed, it is not good manners to look a gift-horse in the mouth, even after we have a right to declare that it *is* a gift-horse.

The most exasperating thought of all, however, is that M. Régamey's idea has, intrinsically, much to recommend it. There are many reasons why Americans should wish in one manner or another to express their gratitude to France. The fact that France gave us the "Liberty" is the very least of them. The strongest are those memories of courteous welcome, helpful example and invaluable instruction which fill the minds of hundreds of American artists who have studied in Paris, and of thousands of observers who prize their subsequent work at home. Here is a vast debt which we very certainly owe. We can never hope to pay it, but it would be both righteous and graceful to recognize it as frankly and as clearly as possible. If our Government would remove the tariff on foreign works of art that, of course, would be the best possible recognition. But, until this can be brought about, the public, or certain sections of the public, ought to try to do what it can. Our architects have set the example by founding an annual *Prix de Reconnaissance*, open to students of French birth only, in their own sections of the École des Beaux-Arts. It would have been an appropriate and graceful act could our sculptors, for example, have learned in some other way of the existence of the Houdon bronze, and have bought it for the school. But M. Régamey, assisted by M. Gonse, has made such an act almost impossible. For Americans to present it in answer to the suggestion of Frenchmen would seem as stupid and perfunctory, as it seemed naïvely and amusingly tactless for Frenchmen to suggest that it might well be given. M. G. VAN RENSSELAER.

CEMENT-STUCCO WORK.

NEW YORK.

TO THE EDITORS OF THE AMERICAN ARCHITECT:—

Dear Sirs,—In your issue of August 27, Mr. A. B. Jennings requests some suggestion for producing an even color on a cement-stucco brick wall, and he is afraid of using paint, because the cement would eat through it. Permit me to recommend your correspondent the use of English "duresco," which I have employed and had under my observation for several years. Cements and lime-mortars do not eat through it, and it is a perfect anti-damp preparation. It can be had brick-red or white, which can be stained to any color, and the shade remains uniform and does not scale or blister.

Yours truly, HOWARD FLEMING.

WASHINGTON, D. C., August 29, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT:—

Dear Sirs,—Your last issue contains a communication from Mr. A. B. Jennings asking what treatment to adopt with a wall stuccoed in cement unsatisfactory in color. I would recommend an application of a strong solution of sulphuric acid to counteract the causticity of the cement, to be afterwards washed with clear water. After drying, the stucco can be painted in oil or distemper in any desired color. Respectfully,

O. VON NERTA.

NOTES AND CLIPPINGS

DESTRUCTION OF BUILDING-STONES.—Mr. Gobin, a French government engineer at Lyons, addresses the following letter to *La Nature* on one of the causes of the decay of building-stones:

"I think I can point out one of the causes of the destruction [of stones] which, as far as I know, has not been noticed, and which acts upon the hardest and most resistant materials, such as granite. This cause is the abrupt expansion produced by the action of the sun when the temperature of the air is very low and the sky is clear. The following are the facts which I have observed and which justify this opinion:

"At Saint-Pal-de-Mons (Haute-Loire) a granite cross is standing in a public square opposite a church, and the inscription upon it shows that it was set up in 1670. The upright portion of the cross is cylindrical and exhibits a curious phenomenon. The superficial layer of the stone has detached itself circularly from the central part to a depth of about half an inch. A portion of this layer has fallen from half the circumference of the upright, and what remains forms a sort of half-sheath,

very distinct from the rest of the mass, so that the whole has the aspect of a fossil-tree that has preserved half of its petrified bark. As the portion of the envelope that has fallen is found at the south side, we cannot see in this phenomenon an effect of frost solely, but must recognize the fact that it is a consequence of the successive expansions and contractions that have been renewed thousands of times since the cross has been exposed to the sun's rays. I may add that the climate of the country is very cold, on account of the great altitude, and that the air is pure and fogless. The action of the sun in winter, then, must produce great differences in temperature.

"A similar, but less marked, phenomenon is observed upon a granite cross in the village of Joux, near Tarare (Rhone).

"Finally, upon the first granite column on the right side of the chancel of the church of Ainay, at Lyons, is to be seen a superficial slab that has detached itself from the mass, and very likely under similar circumstances These columns, in fact, came from a Roman temple, and we may conclude from the fact noted above that the one mentioned stood in the interior of the temple at the south side, or else that in the ruins of the temple it was exposed for centuries to the action of the sun."

Salt.— The fact is probably not generally known that the salt mountains of Nevada, the salt island in Louisiana, as well as various other deposits of chloride of sodium in different parts of the world are almost absolutely pure chloride of sodium. It appears that of 22.28 per cent of salts found in Great Salt Lake, 20.19 per cent is pure chloride of sodium, and yet many of the streams running into the lake contain vastly larger quantities of other salts, some of the water being so heavily charged with nitrates and sulphates of soda and potash as to be unfit for animals to drink. In the lake all the potash salts have disappeared. In the ocean, too, the salts named must, from time to time, have found their way into its waters in immense quantities, and, in respect to what has become of them, it has been suggested that the chloride of sodium may have possessed and exercised the power of separating them and driving them down into the earth beneath. In instances where the water is nearly saturated, as in the Dead Sea and Salt Lake, it might be a question of solubility — it might be that the chloride of sodium was the most soluble, and that in this way the others were precipitated. In the ocean, however, seldom as much as four per cent of the mass is solid material, and the point of saturation for any of the salts is not approached, or, if precipitated from saturation, they would lie on the bottom as crystals; but the fact is, they have disappeared into the earth at the bottom of the sea. The probability is considered to be that by settling down into the mass of earth beneath the sea, they have contributed to increase its specific gravity, and thus enabled it to overbalance the weight of the dry land, and in this way aided in causing the seas to occupy a lower level than the surrounding land.— *Boston Transcript.*

Terra-cotta Tablets from Babylon. — A collection of Babylonian antiquities of great interest is at the present time in the hands of a private collector in this country. The collection consists of a series of about 300 inscribed terra-cotta tablets relating to the revenues and tithes of one of the most ancient of the Babylonian temples. In 1880, Mr. Hormuzd Rassam, when engaged on the works of exploration in Babylonia on behalf of the Trustees of the British Museum, discovered about thirty miles from Bagdad the site of the ancient city of Sippara, one of the chief centres of the religious life of Chaldea, in which was a great temple dedicated to the Sun God. On the return of Mr. Rassam to England native overseers were retained on the site for a short time, but were last year removed. No sooner were these men withdrawn than Arab antiquity hunters from Bagdad commenced their irregular diggings on the site, and the collection which has just reached this country was thus obtained. The majority of the tablets relate to the collection of the revenues of the temple, which were derived from tithes and dues imposed on corn and dates, as well as contributions from pious donors. The new collection of tablets affords very clear indications of the wealth of the land of Chaldea in the seventh and sixth centuries before the Christian era. Thus from one tablet we learn that 4,600 sheep were given to the temple as sheep-dues in one year, the owners being allowed to redeem them on payment of certain sums. In the reign of Darius we have the entry of fifty-four shekels of gold — a metal rarely mentioned in these tablets. One of the most interesting features of the tablets is the great care with which the accounts are kept. The names of the payers are entered in full, and sometimes the name of the father and the trade are given. The amount is entered in ruled column, and separate payments in other columns the total being given at the foot, and the whole sometimes countersigned by witnesses. Independent of their value as indicating the flourishing condition of the land of Chaldea and the richness of the temples, some of these tablets are of great historical value as connecting links in the chain of documents on which Babylonian and Assyrian chronology are based. Every one of them is dated in month, day, and regnal year of the King's reign when the transaction took place, and are, therefore, a most valuable aid to the construction of the chronology of the period. — *London Times.*

The Electric Light in Vienna Opera House. — The Vienna Opera House has now been illuminated by electric light, which has given great satisfaction to the audiences. The system, which is by accumulators, is to be applied to all the theatres and public buildings in the city. The current is supplied from a generating station in the Schenkenstrasse, a central point of the city, and in the building formerly occupied by the British Embassy. Machinery has been laid down here for the supply of 20,000 lamps. The boilers, engines and dynamos were supplied by Messrs. Crompton & Co., of Chelmsford, who sublet the boiler contract to the Wittkowitz Iron Company. Willans' high-speed compound engines are adopted, and Crompton dynamos. Four cables are laid underground to the Opera House, a distance of about three-quarters of a mile. They are connected to the accumulators by four switches. Other wires lead to a switchboard under the stage for the supply of the lamps. Every circuit has a tell-tale or pilot lamp. The original gas fittings of the building have been utilized as far as possible. The accumulators were supplied by the Electrical Power Storage Company, of Great Winchester Street, London. A novelty has been introduced by M. Monnier for the graduation of the stage lights in the form of helical resistances of the platinoid wire introduced to the notice of the electrical world by Mr. Bottomley and Sir William Thomson. These resistances are steeped in oil to keep them cool, the oil being surrounded by a water-jacket. We may add that the lighting of the Opera House was instigated by the Emperor.— *Engineering.*

The Sukkur Bridge. — The Sukkur Bridge has just been completed at the works of Messrs. Westwood, Baillie & Co., London Yard Poplar. The bridge, which is on the cantilever principle, is to be constructed over the Konhri Pass of the Indus, at Sukkur, on the line of railway from Kurrachee and Attock. A noticeable feature about the work is the erection of probably one of the finest pieces of scaffolding which has ever been built, and which has been a conspicuous object on the banks of the Thames at Poplar and for miles round. It is 400 feet long and 120 feet wide, and 180 feet high, with about 2,600 loads of timber, which, if laid out, would measure twenty-four lineal miles, the weight of the bolts, nails, and other ironwork being about forty tons. The contract has taken about two years to complete, the bridge having to be temporarily erected at the works previous to being sent to India. — *Timber.*

Statesmen for Gargoyles. — Some months ago the parish church of St. Giles's, Camberwell, was restored, and a buttress standing at the western corner was ornamented with five gargoyles. These figureheads represent five statesmen — Lord Salisbury, Lord Randolph Churchill, Mr. Gladstone, Mr. Bright and Mr. Chamberlain. This is evidently a new departure in ecclesiastical architecture, for hitherto gargoyles have been representations of grinning devils. The Tories are more severely treated than the Liberals, both Lord Salisbury and Lord Randolph Churchill being a sight for men and angels. — *London Truth.*

TRADE SURVEYS

There seems to be a unanimity of opinion among men representing great manufacturing, banking, railroad and commercial interests that all the conditions are favorable for a continuation of the phenomenal business activity that has characterized the year 1887 thus far. Industrial enterprises are projected with as much faith; capital is expended lavishly; new railroad work is projected on a large scale. Engineering enterprises are looming up. Both foreign and domestic capital is seeking opportunities. Nearly all investments are remunerative. Dividends of all kinds of corporations are regularly paid. The volume of work is increasing. Various trade and manufacturing interests assert that this summer's business has exceeded all previous records. Production is prosecuted on a gigantic scale. The great factors, such as railroad-building machinery-construction and house-building are giving strength to the markets. All statistical reports are encouraging, that of the iron trade is especially so. With a production of ten million tons of iron and steel last year, and an importation of 1,100 000 tons of foreign material, the country is practically bare of iron and steel supplies Over one hundred large iron and steel making establishments from blast furnaces and rolling mills down are either under construction or are projected. Within six months works have been projected for the construction of locomotives which will increase the capacity ten to fifteen per cent. New structural iron mills are under way. Plate mills are sold ahead. Bar-mills are full of orders. Nail-makers east and west are combining and several factories are putting in machinery to manufacture wire nails instead of cut nails, because of their greater service. Within two weeks some of the largest machinery and boiler contracts ever placed have been disposed of and New England makers have taken the cream. Western machinery makers are filling up faster than was anticipated. The demand from small shops, factories and foundries is heavy. The hardware manufacturies have made a better September start than ever before. The nail-makers are holding a convention this week to control competition A score of trade combinations are under way, all aiming at a greater control over production and distribution. The tool and small machinery makers, stove-makers and others who supply farm machinery have started in with a good stock of fall and winter orders. The latest advices from electricians and electrical-supply manufacturers and dealers is to the effect that the facilities of this new industry will be fully taxed The orders are crowding in from hundreds of cities and towns. Manufacturers of belting report business very active. Manufacturers of leather have pushed production rapidly and prices are only barely remunerative. Producers of textile goods have a good outlook and a great many mills are increasing their facilities. The lumber interests are struggling for better prices and complain generally of a scarcity of cars. The heavy railway traffic is stimulating a heavy demand for rolling stock. All kinds of lumber is moving quickly and a higher range of prices is hoped for. An increasing demand for lumber is observed throughout the West. There is no observable decline in building activity in the larger and smaller cities The reports show that the building season is an extremely active one and that the demand for house and shop room and for buildings of all kinds is stimulating enterprise. The builders have reason to rejoice over the success enjoyed. Material is steady and in abundant supply. Labor has consented to let matters stand for the present though in some channels there are probabilities of serious trouble. The coal trade is active and production is six million tons ahead of last year. Natural gas production is increasing and manufacturing demands are stimulating the construction of new lines. Railroad companies have been again considering the question of using petroleum for fuel, but so far with unfavorable results. Architects report favorable indications for the future. Large buildings for office and business purposes are wanted and work will begin on many new buildings this winter. The best authorities among architects anticipate a good year in 1888. House building will not fall off from present indications. The financial outlook is favorable in spite of all appearances to the contrary. The credit of the business interests was never better and all influences at work are contributing to a strengthening of the financial situation.

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CONTENTS

THE Twenty-first Annual Convention of the American Institute of Architects will take place in Chicago, on Wednesday, Thursday, and Friday, October 19, 20 and 21 next. The full programme of the proceedings is not yet ready, but the Convention is in the hands of an admirable committee, and there can be no doubt of its success. Among other things, it is proposed to have a much more complete exhibition of the works of members than has ever yet been attempted, and an earnest invitation is extended to all who have photographs or drawings of buildings executed by them within the last ten years to forward them, for exhibition first at the October Convention, and then, by request of the Western Association of Architects, at the convention of the latter body, which takes place in November. We wish that the meetings of the architectural societies could be held in winter, instead of in the busiest season, with, perhaps, the exception of the early spring months, in the whole year; but to those who have leisure for the journey, the middle of autumn is a very pleasant time to see new places, and Chicago, particularly, will be almost at its best then. The Western Association has courteously appointed its President, Mr. Root, its ex-President, Mr. Adler, and its Secretary, Mr. Alexander, to represent it in the Convention, and the meeting ought to be unusually interesting and important.

MR. DETLEF LIENAU, one of the oldest practising architects in the country, died in New York on the twenty-ninth of August last, after a short illness. Mr. Lienau was a Dane by birth, but was educated in Germany, completing his training as an architect in Paris, under the great Labrouste. Soon after this he came to New York, establishing himself in practice at a time when architects were few there, and their employment rather uncertain. He soon secured reputation and employment, and his painstaking fidelity to detail gradually made him an authority in matters of construction, so that, while carrying on his private business, he was for many years one of the most trusted members of the Board of Examiners constituted by the New York law as a tribunal of appeal from the decisions of the Inspector of Buildings. Although quiet and unobtrusive in disposition, and unable, through the distance of his residence from New York, to take a very active part in the proceedings of the architectural societies of the city, he was greatly interested in all movements for the good of the profession, and was one of the first members of the American Institute of Architects, repeatedly holding office, if we are not mistaken, in the New York Chapter.

THE burning of the Exeter Theatre, in England, by which nearly two hundred persons lost their lives, has called renewed attention to the dangers which those who enter theatres are compelled to face, and renewed inquiry as to the means of avoiding them. The history of the Exeter fire does not seem to have been very different from that of other catastrophes of the kind. The stage happened to be encumbered with an unusually large amount of scenery, which was in course of preparation for a pantomime. This caught fire, sending torrents of smoke into the auditorium; the audience tried to rush out, but there was only one door, and those who had farthest to go to reach it were kept back by the struggling crowd until they were suffocated, and the flames burned their dead bodies beyond recognition. The town firemen tried to do something to check the fire, but found their efforts useless, and were obliged to content themselves with rescuing a few of the fugitives; and one of the most skilful fire-engineers in England, on viewing the scene of the conflagration, remarked that any fire-service that could have been provided in the building would have been powerless against the effect of the sudden combustion of so much inflammable matter. This opinion, which was probably well founded, is in striking accordance with the observation made by an officer of the Paris fire-guard, which, we may remember, is a picked body of soldiers, drilled and exercised to perfection. This gentleman, speaking of the precautions against fire which the law requires in theatres, and particularly of the firemen always stationed on the stage in Paris, said that the only real use of these men was to reassure the audience, which felt itself safer in sight of their uniforms. "If," he continued, "a serious fire should break out behind the scenes, their skill and courage, aided by the appliances for drenching the stage with water, which are lavishly provided in French theatres, would be of no avail whatever." Such a man would not speak without knowledge, and would be likely to know thoroughly what he was talking about; and, strange as his opinion seems to those who remember the lines of coiled hose, the automatic sprinklers, the water curtains, and the thousand and one fire-extinguishing appliances of modern theatre construction, it must be acknowledged that the history of recent theatre fires confirms it. It cannot be too often repeated, that smoke, not fire, is the fatal agent in such cases, and this acts very quickly. To cite again some curious statistics on the subject, the average time that elapses between the appearance of fire inside the proscenium arch, and the total extinction of human life in the auditorium, is about five minuets, the longest time recorded having been eight minutes and the shortest two, while most have ranged from four to six minutes. It is obvious that no fire-service, even if it succeeded in extinguishing the flames, could dissipate the smoke from a pile of burning scenery in five minutes, and, indeed, the effect of pouring water on the blazing mass would for a time be to increase the volume of smoke, and with it the danger to the audience. In the few instances where water has been thrown on a fire behind the scenes, the absence of good effect seems to indicate that this was the result; and the lesson of all recent fires in theatres is, as we have before remarked, that, no matter how modern, or carefully built, or thoroughly equipped a theatre may be, the only safety for those who go to it is to make themselves acquainted with the shortest path from their seats to the nearest door, and, on the first sign of smoke from behind the curtain, to run for their lives. If only those who can reach the door in one or two minutes are likely to be saved, as seems to be the rule, the obvious way of securing safety to as large a number of people as possible is to provide many doors; and, in our opinion, this should be the cardinal principle of theatre-planning, until the construction and furnishing of the stage is much altered from the present practice. The most elaborate system of pipes, sprinklers, iron curtains and stage ventilation, in a theatre with inadequate exits, at best makes the lives of the audience dependent upon the perfect working of a complicated mechanism; but if a hundred or more doors are provided, in all parts of the auditorium, through any one of which may be immediately reached the safety of a fireproof corridor opening to the outer air, with plenty of stone staircases leading to the ground, the spectators need not trouble themselves about conflagrations on the stage, however violent. There are theatres now in use from which the audience can, and generally does,

disperse in two minutes, and a test like this, reducing the time still further, if possible, is, under our present knowledge, the only reliable one of the fitness of a theatre for public use. To be safe, the corridors into which the doors from the auditorium open should be secure against danger from smoke, either by providing them with many windows, or, still better, by making them open colonnades; and a liberal number of fireproof staircases should connect them with the ground. Something may be done in a different way by planning the auditorium so as to communicate with adjoining rooms, and through these with the outside air, as is done in the Eden Theatre in Paris, and, in an imperfect way, with one or two theatres in New York, but the sufficiency of this resource is a matter to be carefully determined in each case.

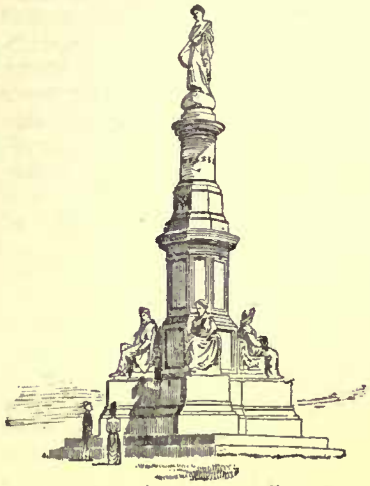
A LARGE hotel is to be built at Los Angeles, California, and an invitation has been issued to architects to submit competitive designs. As the designs are to be sent in before September 20, and as a fair premium is offered, we suppose that a good many architects have by this time a certain interest in the matter, and will be glad to know how one, at least, of the aspirants for the honor of carrying out the work proposes to conduct his campaign. According to the Los Angeles *Herald*, a meeting of the subscribers to the fund for constructing the building was held the other day, at which the announcement was made that the entire sum, of one hundred thousand dollars, had been secured, so that the success of the first step in the enterprise was certain. Amid the congratulations which followed the communication of this good news, a proposal was brought in from a certain architect, volunteering to draw all plans of all sorts, and all working-drawings, and superintend the erection of the building, for a commission of three per cent, half to be paid in cash, and half in stock in the enterprise. The audience does not seem to have known just what to do with this interesting document, and referred it without discussion to the subscribers. When it comes up for action before these gentlemen, we advise them to refer it to the ash-barrel. If a public announcement of a man's feeble sense of honor, readiness to betray trust reposed in him, and low opinion of the value of his services, is calculated to ingratiate him with the most public-spirited business men in the beautiful "City of the Angels," they are very different from such persons in other places. Of course, there is no reason why the managers of such an enterprise should not get their professional advice at the lowest price suitable to the kind of advice they want; and there is still less reason why an architect should not take part of his pay in stock of any kind, if he wishes to invest his money so; but the Los Angeles people evidently think that the best professional service is the most profitable in the end, and are trying to get it; and an offer of cheap advice in place of good is likely to be about as attractive to them, independent of considerations of honesty, as would be to a lover, let us say, in search of a stylish tailor to make his wedding clothes, the solicitations of a vender of Chatham-Street misfits.

THE great English competition for the Admiralty and War Office, which took place about two years ago, has had a rather ignominious ending. The contest was won by Messrs. Leeming and Leeming, men then almost unknown in the profession, who sent in an agreeable Classical design, not strikingly original, and not altogether free from mistakes of architectural grammar. Certain architects criticised the work with unnecessary and ungenerous harshness, and it was even proposed to call upon the Government to withdraw the commission from the Messrs. Leeming, in the interest of art, just as in this country, years ago, a meeting of architects was held in New York to protest solemnly against the execution of the present design for the Albany State House in place of that of Messrs. Fuller and Laver. Fortunately for the Messrs. Leeming, and, as an example, for the profession in general, the English Government kept to its choice; but directions were given the architects to modify their design, which they did, with signal success. Here the matter rested, until some economical official suggested that money might be saved by altering over the existing buildings, instead of constructing new ones; and it seems to have been now fully decided to adopt this idea. Of course, the Government recognized the claim of the Messrs. Leeming to fair treatment in the matter, and the order has just been issued to pay them the sum of forty thousand dollars, as compensation for the abandonment of the scheme.

SOME one writes to ask us if we consider it a part of an architect's duty to roll pipes down planks, as in the method of testing them for uniform thickness, which we recently described. This is a question of great importance, as hardly any two architects agree as to the extent to which their duties of supervision should be carried. Practice in the profession varies widely, some architects taking great pains to examine materials as well as workmanship, while others think that they have done all that can be required of them if they visit their buildings two or three times a month; and many disclaim all interest in details of construction and entrust their superintendence to an "out-door man," engaged for the purpose. We should be very glad, in the interest of the profession, to have some expression of opinion on the subject, but will suggest, meanwhile, that it would be impracticable to lay down any rule as to the frequency of the visits which an architect should make to his work to fulfil his duty, or in regard to the course of investigation to be followed at his visits. Briefly, an architect is expected to know good material and construction from bad, and to take reasonable pains, in the interest of his clients, to discover and reject bad work. He is never regarded, by the courts of any civilized country, as responsible for the faithfulness of the builder, although unscrupulous clients often pretend to consider him so; but he is bound to be fairly quick in detecting errors, and reasonably well acquainted with the current modes of testing work of which he has suspicions. The art of observing quickly and carefully is not easily acquired. Draughtsmen in offices are often almost useless in superintending, for the reason that they become dazed by the complexity and variety of the operations carried on at the building, and stand vacantly about, while gross mistakes are being committed under their very eyes; and architects of considerable experience frequently find themselves overlooking important points. They are usually careful to rectify the omission later, but in case they fail to do so, the tendency of juries is to find them seriously at fault. In one noted instance, where an architect had ordered a rather difficult operation of raising an iron girder, the operation failed, and the girder fell upon a workman and killed him. The widow sued the architect for damages and he was compelled to pay five thousand dollars. There can be no question that if the accident had been due to a flaw in the iron, which could not have been discovered by ordinary expert observation, the architect would have been relieved of responsibility; and if his plan of raising was skilful and good, and he had taken pains to see it carried out, and it had failed through the unexpected carelessness of a workman, he could hardly have been condemned to pay damages; but the evidence showed that he was absent while the raising was going on, and the jury considered that this constituted a failure to do his duty in connection with so important a matter, and made him suffer accordingly. Although this was regarded at the time as rather harsh treatment of the architect, the case shows clearly the prevailing opinion that a man of science, to whom is entrusted the supreme direction of certain matters, ought to know at what moment his skill will be most needed, and take pains to be ready with it at those moments. In the same way he ought to know wherein defects in workmanship and material are most likely to occur, and to direct his attention opportunely to those points. So, to recur to the special instance which our correspondent mentions, while an architect could hardly be expected, under ordinary circumstances, to spend his time in rolling all the iron plumbing-pipes for a house down a pair of planks, it would, nevertheless, be prudent for him, if he found pipes delivered at the building of an unfamiliar make, or if he should have reason to doubt their quality, from the appearance of broken sections of pipe, or other circumstances, to test a number by rolling, or any other simple method. This would give him the general idea of their quality, which, in such a case, is all that he is expected to possess, and if he should direct the plumber's foreman to continue the test until all had been tried, and the bad ones rejected, he might be tolerably sure that a jury would not hold him responsible for the consequences of the breaking of a pipe later. Of course, he might not be held responsible if he did not try the pipes, and probably would not be if he could show that he had good reason, by previous knowledge of that make, for believing them to be good; but an architect who confessed that he knew nothing about the quality of certain important materials used under his supervision, and had not tried to ascertain it, would be certain to gain the unfavorable opinion of a jury, as well as of his clients.

BUILDING ACCIDENTS.[1] — IV.

ACCIDENTS DUE TO EXPLOSIONS OF STEAM BOILERS.



GETTYSBURG MONUMENT
DESIGNED BY J.G. BATTERSON.

A RARE, but terribly serious cause of accidents to buildings, and one which is peculiarly frightful, in consequence of the horrors often attending it, as well as of the mystery which is very generally supposed to surround it, is the explosion of the steam boiler. There are in this country somewhere between 200.000 or 300,000 boilers probably, for it is difficult to obtain a statement that is very exact, and of these about one in every 10,000, at least, explodes annually. Careful supervision and the inspection of the boiler at regular intervals, as is done by the insurance companies, reduces this proportion greatly; but the risk accepted in the introduction of an ordinary steam boiler into a building is something to be considered, nevertheless.

A steam boiler is just as truly a magazine of energy as is a powder-magazine; and, in some sense, it is a much more dangerous magazine than the latter. It is absolutely certain that the powder can do no harm, and can give rise to no danger, so long as no fire reaches it — and that is a contingency which is very easily provided against; but a steam boiler is a magazine liable to apply its encaged energy, and that in enormous amount, to the destruction of the building, and of everybody near it, in consequence of the action of any one of many causes. The match is always lighted and hovering about it. The wonder is, not at all that so many explosions occur, or that they are so destructive of property and fatal to life, but rather that they so seldom take place, and that so little injury to property and so little loss of life follow such an accident. Were the amount of this stored energy realized, there would be much less surprise manifested at the destructive effect produced when it is set free by an explosion, and there would be fewer attempts to explain a so-called "mystery" by reference to unfamiliar and more mysterious causes. Were it realized that the energy stored in a steam boiler often represents that of many pounds of gunpowder, and that the great boilers formerly so common on our great river boats, even when carrying but comparatively low pressures, enclosed the equivalent of a very considerable fraction of a ton of powder, the destructive effect of a locomotive or of a Mississippi River explosion would be much less astonishing and mysterious.

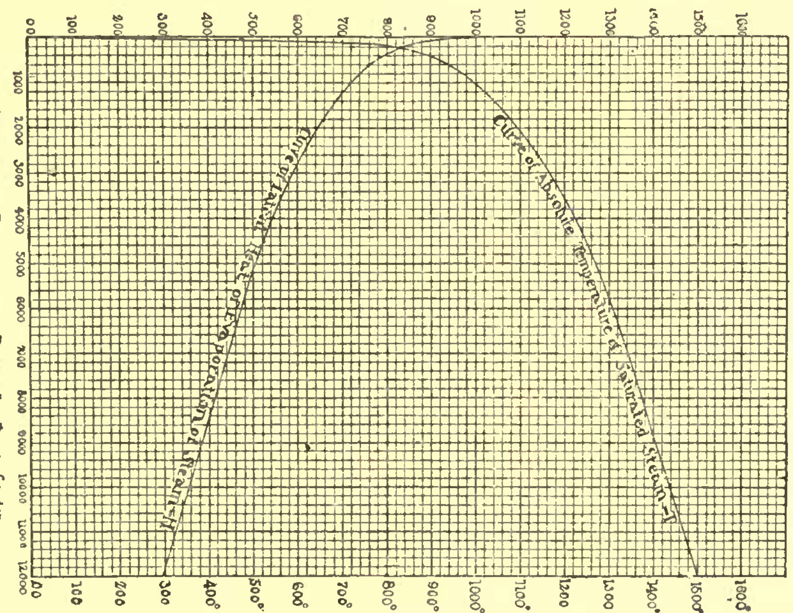


Fig 1

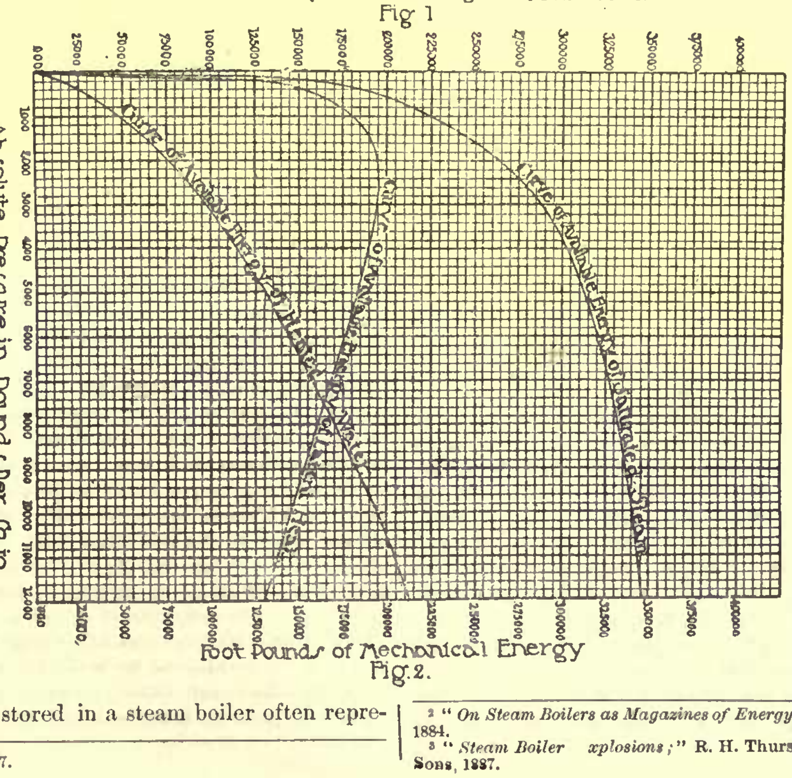


Fig.2.

The writer has taken occasion to have the amount of this stored energy calculated (See Figures 1 and 2) for a wide range of temperatures and pressures.[2] The results of calculation from well-established data show that the portion of stored energy which may act by conversion into mechanical energy from the primitive form, heat-energy, on the explosion of a boiler is such that, at fifty pounds pressure per square inch, it is sufficient, in the case of water at the temperature due the pressure, to raise its own weight a half-mile into the air; while the energy so derived from a mass of steam at the same temperature and under that pressure would raise its weight twelve miles high. At seventy-five pounds the figures become four-fifths and seventeen miles for water and steam respectively; and at one hundred pounds one mile and twenty miles. But while these figures show an enormous difference in the stored energy per pound weight of the two forms of fluid, and that steam stores vastly more than the water in contact with it and at the same temperature, pound for pound, the fact is that the water in all ordinary forms of boiler, as a mass, stores enormously greater amounts than the steam present with it. Calculating these quantities for some of the more familiar forms of steam boiler, we obtain the following table:[3]

Of the boilers here considered, Nos. 1, 2, 3, 4 and 13, 14, 15 are forms not infrequently used in the heating of buildings and in furnishing power to manufacturing establishments; the others are types in use mainly for marine purposes and in locomotive engines. Number 1 is the common "plain cylindrical boiler," one of the most familiar and simplest of known forms. The dimensions assumed are those taken by the writer, in some cases, in designing for such work, and may be considered as representing ordinary practice. This boiler, as is seen in the table, carries 100 pounds of steam, is rated at ten horse-power, though often rated higher, and stores 47,281,898 foot-pounds of available energy, of which less than fifteen per cent exists in the steam. This boiler, which is thirty inches in diameter, and as many feet in length, thus encloses sufficient power to raise itself over 18,000 feet, or nearly four miles high, were all this energy so applied. It is equivalent to the energy of impact at short range of the projectiles of a battery of siege artillery consisting of about fifty thirty-pound rifles. But this is less than one-half

[1] Continued from page 72, No. 607.

[2] "*On Steam Boilers as Magazines of Energy;*" Trans. Am. Soc. Mech. Eng'rs; 1884.

[3] "*Steam Boiler xplosions;*" R. H. Thurston, p. 20; New York: J. Wiley & Sons, 1887.

TOTAL STORED[1] AVAILABLE ENERGY OF STEAM BOILERS.

Type.	Area of		Pressure. lbs. per sq. inch.	Rated pow'r. H. P.	Weight of			Stored energy in (available)			Energy per lb. of		Max. height of projection.		Initial velocity.	
	G. S.	H. S.			Boiler.	Water.	Steam.	Water.	Steam.	Total.	Boiler.	Tot. w't.	Boiler.	Total.	Boiler.	Total.
	Sq. feet.				lbs.			Foot lbs.			Foot lbs.		Feet		Ft. per sec.	
1 Plain cylinder	15	120	100	10	2500	5764	11.325	46,605,200	676,698	47,281,898	18913	5714	18913	5714	1103	606
2 Cornish	36	730	30	60	16950	27471	31.45	57,570,750	709,310	58,260,060	3431	1314	3431	1314	471	290
3 Two-flue cylinder	20	400	150	35	6775	6840	37.04	80,572,050	2,377,357	82,949,407	12243	6076	12243	6076	888	625
4 Plain tubular	30	851.97	75	60	9500	8255	20.84	50,008,790	1,022,731	51,031,521	5372	2871	5372	2871	588	430
5 Locomotive	22	1070	125	525	19400	5260	21.67	52,561,075	1,483,896	54,044,971	2786	2189	2786	2189	423	375
6 "	30	1350	125	650	25000	6920	31.19	69,148,790	2,135,802	71,284,592	2851	2231	2851	2231	428	379
7 "	20	1200	125	600	20565	6450	25.65	64,452,270	1,766,447	66,218,717	3219	2448	3219	2448	455	397
8 "	15	875	125	425	14020	6330	19.02	64,253,160	1,302,431	65,555,591	4677	3213	4677	3213	549	455
9 Scotch marine	32	768	75	300	27045	11765	29.8	71,272,370	1,462,430	72,734,800	2689	1873	2689	1873	416	348
10 "	50.5	1119.5	75	350	37972	17730	47.2	107,408,340	2,316,392	109,724,732	2889	1968	2889	1968	431	356
11 Flue and return tubular	72.5	2324	30	200	56000	42845	69.81	90,531,490	1,570,517	92,101,987	1644	931	1644	931	325	245
12 " "	72	1755	30	180	56000	48570	73.07	102,628,410	1,643,854	104,272,264	1862	996	1862	996	346	253
13 Water tube	70	2806	100	250	34450	21325	35.31	172,455,270	2,108,110	174,563,380	5067	3073	5067	3073	571	445
14 "	100	3000	100	250	45000	28115	58.5	227,366,000	3,513,830	230,879,830	5130	3155	5130	3155	575	450
15 "	100	3000	100	250	54 00	13410	23.64	108,346,670	1,311,377	109,624,283	2030	1626	2030	1626	361	323

[1] This "stored" energy is less than that available in the non-condensing engine by the amount of the latent heat of external work $(p_1 - p_2)\, v$.

the destructive power encaged in some of the marine boilers now in use on transatlantic steamers, as is shown by No. 10 of our table, for example, or in many powerful land boilers, such as Nos. 14 and 15, or in the plain tubular, our most common form of heating boiler, when made of 100 horse-power, a not uncommon size. It is evidently not at all extraordinary that the explosion of such boilers, setting free as it does, these enormous and inconceivable quantities of energy should so often be followed by fearfully fatal and destructive consequences.

The Cornish boiler, No. 2 on the list, is one rarely seen in this country, and almost never applied to the purpose of heating buildings simply. It is seen in one of its most common sizes, and not at all a large boiler either, to store some twenty per cent more energy than the boiler first described. In this case, as in most of those here given, the boiler selected for computation is one either designed by, or operated at some time by the writer, and representing usual sizes and powers. No. 2 is a boiler of much greater weight, as compared with its stored energy than No. 1, and the height of projection corresponding to the stored energy is but about 3,400 feet. No. 3, a form of boiler now less frequently adopted than formerly, but one very usual still, where the feed-water is not pure, has about twice the stored energy of No. 1; but its height of projection is about two-thirds as great. No. 4, is the most commonly used of all forms of stationary boiler, both for heating and for power. That here taken is a very frequently adopted size; but it is not unusual to see them of 100 horse-power, or double this size. That here taken would be rated at from fifty to sixty horse-power, and stores sufficient energy to raise its own weight just about one mile, expending in the operation the equivalent of the energy of our fifty-gun battery, and a little more. The last three boilers on our list are so-called "water-tube" boilers of large size, boilers which are often known as "safety" boilers. It is at once seen that they do not necessarily enclose small amounts of destructive power. The claim made for them is simply that, whatever quantity of energy may be stored in them, its expenditure cannot be effected in a dangerous way, and that they are safe from explosion of a destructive kind. Their weights are seen to be comparatively great for their weights of enclosed fluids, and the height of projection comparatively small — 400 to 600 feet. The writer has never known of a seriously destructive explosion produced by any boiler of this class. Their immunity from danger of this sort is gradually bringing them into use, and while they are still vastly outnumbered by the older kinds of boiler, they are steadily coming in to occupy the field, and it seems very probable that ere long, they may assume a very prominent place in our statistics of boiler-power.

The locomotive boilers, Nos. 5 to 8, concentrate a very considerable amount of energy, and at very high pressures. They are heavy, however, in proportion to the quantity of fluid contained within them, and the height of projection given in the table thus happens to be no more than the average of other types of boiler. The violence with which they explode, and they explode not infrequently, measures, in some sense the destructiveness and danger to life which comes of high pressures. It is evident that, whatever amount of energy is stored in a boiler, it is incapable of doing harm unless under pressure, and that the danger increases as the pressure rises. These two quantities, amount of stored energy and pressure of steam carried, are two factors the product of which may be taken as measuring the dangerous character of the magazine. On the other hand, the danger arising from explosion is lessened when this stock of energy is so disposed that it cannot be all freed at once, as, for example, in the sectional boilers, where only a small fraction of the whole can be set free at any instant. Here the danger is the greater as pressures are higher, and less as the number of the sections is increased and their individual size diminishes. In some cases, also, as in the case of tubes, the rupture of the member is very certain to take place locally, and not by the explosion of the whole vessel, and thus the single part acts as a safety-valve, securing immunity from, instead of itself being a source of, danger.

The form of the boiler also determines what shall be the method of explosion, should it occur, and the manner in which the work of destruction will be accomplished. Thus, the upright tubular boiler usually gives way by forcing its lower tube-sheet down into the furnace, or by the "caving-in" of the furnace sides; in either case permitting the steam and water to issue at once, as a mass, at the bottom, and, by its reaction, throwing the boiler upward, traversing the air like a rocket and destroying whatever may be in the line of its motion. A cylindrical or tubular boiler is apt to break in two, and to project the two ends in opposite directions, tearing down walls and breaking up every structure lying in its own plane. At the same time, often, its shell breaks up, and the flying pieces deal wide-spread destruction. Of all these forms of boiler, those are most to be dreaded which, being capable of complete disruption, contain most water and explode at highest pressure. Thus the plain cylindrical boiler and the flue boilers are dangerous, as containing large bodies of water; the locomotive as working under high pressure, while the shell boilers, as a class, are dangerous in comparison with the sectional, because they are so constructed that they may set free the whole mass of contained energy instantaneously by explosion, the sectional only exploding a single small division of the structure at any one time.

The causes of steam-boiler explosions are commonly traceable after the accident has occurred, and are now known to be, certainly in the vast majority of cases, thoroughly well understood, perfectly simple in character. The writer has sometimes classified them under three heads; thus, (1) Ignorance; (2) carelessness; (3) absolute recklessness. In all instances investigated by the inspectors of the insurance companies, repairs indicate that either the boiler was too weak for its work, or that the steam-pressure was above that considered safe. Where the weakness is local the result is usually a "burst," as the engineer designates it, rather than a true "explosion," the steam and water being discharged without displacing the boiler or doing much, if any, damage to surrounding objects; but if the break is extensive, the result is apt to be an explosion in which the stored energy is all liberated on the instant to do its fearful work. Ignorance may have produced a design of boiler unfitted for its purpose; or it may have made too weak a structure, by error in form, or material, or in construction; or it may have led to mistakes in operation. Probably a very large proportion of observed explosions have been due to sheer carelessness or thoughtlessness on the part of the attendants, and many have been brought about by criminal recklessness.

Statistics show that from about one-third to one-half of all explosions reported are caused by deterioration or corrosion of the boiler or attachments, from one-fourth to one-third to defects in design or construction, a small percentage to "low-water," and the rest to other results of ignorance or carelessness.

Sediment and incrustation, producing overheating of the metal under the deposit, introduce danger very frequently; general corrosion, and especially the form of corrosion known as "grooving" or "furrowing," which takes place along any line of lap or other line of exceptional stiffness, and which thus localizes strains and rusting, produce a very large proportion of such "accidents," so-called. Bad workmanship and material lead to numerous defective and dangerous injuries of boilers. Overloaded and stuck safety-valves are a prolific cause of danger.

In earlier days, and even now among the few veteran engineers surviving, it has been the general and almost universal belief that a real explosion could only occur when, the water being allowed to fall below the level of the heating surfaces, fresh water is thrown in upon the overheated metal, and, being instantly evaporated, the steam so produced, adding its pressure to that already existing, causes explosion. But this is now known to be incorrect, and the great majority of explosions are due to the gradual increase of steam-pressure, or to the decrease of strength of the boiler by corrosion, until rupture takes place. That low-water does not necessarily lead to explosion has been proved by many instances of the contrary experience, some accidental, some purposely produced. As long ago as 1811, Captain Bunker, then in command of the first of the many steamboats built by the Stevens, father and son, for navigation of the inland waters of the Eastern States, found his boilers, on two occasions, quite empty, in consequence of the carelessness of the firemen, and filled them up, pumping the feed-water into the red-hot boiler. He observed no other or more startling phenomenon than a crackling sound as the water cooled the overheated iron. The writer has seen the same experiment made repeatedly, in the course of the work of a commission appointed to investigate this subject for the Government, and on several occasions with the same result, but in one instance with the effect of exploding the boiler. It is not a safe method of meeting that emergency. In such cases, the fire should be at once covered with wet ashes and then hauled, and the boiler cooled down and examined, before taking steps toward getting up steam again.

The overheating of the water, the entrance of the water into what is known as the spheroidal state, the decomposition of water into its constituent gases, the action of electricity, and other theories which are often proposed to account for the explosion of the steam boiler are probably all nearly equally improbable. There is, however, enough evidence of the possibility of heating the surfaces of the boiler, below the water-level, to a high temperature, and of consequent repulsion of the water from them, to cause many experienced engineers to attribute to this action those peculiarly violent explosions which are occasionally observed. It is supposed that the return of the water upon the sheet, as pressure rises, or as the metal cools to the temperature of restored contact, causes an exceedingly sudden production of such large quantities of steam as to give rise to an impact upon the sheet exposed to this action sufficient to break it into pieces. The experiments of Mr. Lawson, however, would seem to indicate that it is unnecessary to resort to so doubtful an hypothesis, and that the "geyser" theory of Clark and Colburn, which is now generally accepted by engineers, will account for all such cases. This theory, original with Mr. D. K. Clark, though first published by Zera Colburn, probably, and by him credited to Mr. Clark, considers that the opening of a rent in the boiler, at any point not far removed from the steam-space, leads to an outrush of steam, carrying with it masses of water which are projected with all the effect of "water-hammer" upon the edges of the opening, tearing it further, and thus progressively, but with enormous rapidity, breaking up the boiler and setting free all its stored energy to propel the detached pieces as so many projectiles in all directions, and with the velocity and destructive effect of so many cannon-shot. These ruptures once started, the tearing proceeds in all directions, and, often, without much reference to the strength of the iron, ripping strong as well as weak seams, and tearing good iron about as readily as that weakened by corrosion. A strong boiler is thus sometimes torn into many pieces, and its effect on surrounding objects is that of a battery of artillery loaded with grape or shrapnel. Such instances are, certainly, however, comparatively rare. The most terrible explosions, in violence and destructive effect, are usually those in which a strong boiler, well supplied with water, in consequence of a stuck safety-valve, or other defect of attachments, or by fault in management, resists a gradually increasing steam-pressure, until finally, reaching the limit of its strength, it gives way under abnormally high pressure, and, torn into pieces in the manner just described, sends its death-dealing projectiles in every direction, destroying the building in which it is placed, and, often, killing unsuspecting people hundreds of yards away.

We can hardly pick up a newspaper without finding an account of such a catastrophe, and frequently a list of killed and wounded that reminds one of the days of the civil war. Fortunately, thanks to the growing intelligence of those who have to do with steam-boilers, and especially to the work of the insurance companies and their inspectors, these accidents are continually becoming more rare and less fatal. They should become unknown; for it is well established that a well-designed, well-constructed and well-managed boiler does not explode.

To secure safety against explosions, it is now obvious, we must make sure of a good design, of good construction, and of intelligent and conscientious attendance. A good design is secured by the employment of intelligent, reliable and reputable engineers as designers. The majority of the boilers now put on the market are designed by such men, as every reputable firm employs an experienced and well-informed designer. Of all the designs now in general use, probably the plain tubular boiler is most common. It is capable of being made thoroughly strong, and safe against accident so long as it is properly cared for, is economical and compact. It should, however, always be kept under careful and skilful inspection, and the writer would always advise insurance with a strong and reputable company, even more scrupulously, if possible, than other property. Danger need never be incurred with this or, indeed, with any good form of boiler; but, should explosion take place, the results are certain to be serious. The sectional boilers, as already stated, are coming more generally into use, and, as the writer believes, more wisely, since they can not only be preserved as readily as the other forms against explosion; but should, through any cause, rupture take place, they cannot produce the disastrous effects so invariably observed when the "shell-boiler" explodes.

Good construction is insured by employing good makers, and, where the boiler is built to specifications furnished by the purchaser, by the employment of good inspectors during construction. When the boiler is purchased from the maker, already built, the buyer must trust to such inspection as he can make, or such as his inspector can make, of the finished structure. Makers of good reputation can be trusted to do their best; but even they sometimes make a slip, and the most careful examination of material and construction should always be made for the purchaser before the boiler is accepted. All attachments, and especially the feed apparatus and the safety-valves, should be selected by an expert and as carefully examined in place, and before the boiler is used, as the main structure itself. The material in the best boilers is a soft and ductile yet tenacious steel.

Proper location means the selection of the best position in which to place the boiler, not only with reference to its use, but and especially with regard to the safety of surrounding property and of lives, in case of accident. If the boiler is so set that its explosion is not likely to do harm, it may usually be said to be well located; but it should also be so placed that good feed-water is obtainable, and so that the steam may be conveniently taken to the point of application. The writer would prefer to set all shell-boilers in separate boiler-houses, and in such direction that explosion would be unlikely to impel their parts into the main building. Sectional boilers may be admitted into the building itself; but even then, the steam-drums and steam-pipes adjacent to the boiler, and especially if of considerable size, should be kept under constant inspection.

Safe operation and management can be only secured by the employment of men known by experience to be intelligent, conscientious, prompt in action, and reliable and ready in emergencies. Such men can only be had by paying good wages. They are always well worth all that the market demands for them, and the proprietor will usually also find that the sense of comfort and safety which comes with the entrance of a thoroughly good man into a boiler-room is worth vastly more than any difference of pay that might have been saved by the employment of one less experienced or less reliable. It may also be remarked that the cost of fuel is commonly so large, in proportion to other costs, that the good firemen will save, as a rule, many times the difference in wages; in fact, the cost of labor is here a matter of insignificant importance.

Any proprietor who has well-designed and well-built boilers, properly set in a safely located boiler-house, if well insured and kept inspected, and if managed by the right kind of attendants, may sleep in peace, assured that he is practically safe against this class of "*building accident.*" R. H. Thurston.

[To be continued.]

ILLUSTRATIONS

[*Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.*]

HOUSE OF WILLIAM EDGAR, ESQ., NEWPORT, R. I. MESSRS. MCKIM, MEAD & WHITE, ARCHITECTS, NEW YORK, N. Y.

[Helio-chrome, issued only with the Imperial Edition.]

THE ROTCH TRAVELLING-SCHOLARSHIP DRAWINGS. — PLATES LVIII, LIX, LX.

[Issued only with the Imperial Edition.]

HOUSE FOR CHARLES A. KEBLER, ESQ. MESSRS. BUDDEMEYER, PLYMPTON & TROWBRIDGE, ARCHITECTS, CINCINNATI, O.

THIS house is built of pressed brick, laid Flemish bond, for first story and for chimneys, and of half-timber for second stories and gables; all constructive work and outside finish being done in Tennessee red cedar, with cypress for porches. Creosote-stained shingle roof. The first-story main rooms and hall are finished in hard wood, and the remainder of house in selected white pine. The cost was in the neighborhood of $16,000.

KENWOOD EVANGELICAL CHURCH, KENWOOD, ILL. MESSRS. W. W. BOYINGTON AND H. B. WHEELOCK, ASSOCIATED ARCHITECTS, CHICAGO, ILL.

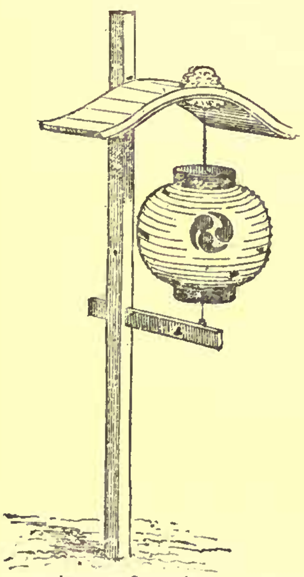
DESIGN FOR THE TOWN-HALL, GREAT BARRINGTON, MASS. MESSRS. STONE, CARPENTER & WILLSON, ARCHITECTS, PROVIDENCE, R. I.

CHURCH AT CUNAULT, FRANCE.

TECHNOLOGICAL SCHOOL, ATLANTA, GA. MESSRS. BRUCE & MORGAN, ARCHITECTS, ATLANTA, GA.

BUILDING MATERIALS.[1] — IV.

PRESERVATION OF STONE.



Japanese Street-Lantern.
From Morse's "*Japanese Homes.*"

THE question of the preservation of stone is one upon which much time and trouble have been expended without, however, leading to the attainment of any very satisfactory results, inasmuch as when good stone is employed no preserving process is required, and if, unfortunately, the best has to be made of inferior stone, it is only in exceptional cases that the cost and trouble involved in the adoption of any such process is likely to be incurred upon an extensive scale.

When the extent of the decay which had taken place in the stone of the Houses of Parliament was first fully realized, it created a good deal of excitement, and a Government Commission was appointed to inquire into the subject, who invited proposals for arresting its progress. In answer to this invitation, a great number of projects were brought forward for the attainment of the desired object, differing widely from each other in their character, many of them being the outcome of much thought and careful study of the question, whilst others were of a very crude nature and had no pretensions to any merit.

The principle upon which any process of this kind depends for success is evident, for since it is by means of water that the acid matters which act so injuriously upon stone obtain access to it, any process which succeeds in filling up the pores with some material of a permanent and unalterable character must be likely to act as an effective preservative. This, at first sight, would seem very easy to accomplish. There is no difficulty in closing the pores of a piece of soft chalk or Caen stone, so as to harden the surface and make it non-absorbent of water. When, however, stone is once in position, and we have it in the form of a vertical wall, the task is a more difficult one. Under such circumstances it is impossible to make any solution penetrate to a sufficient depth by a single application; it requires to be frequently repeated, beginning with very weak solutions, before the stone can be made to absorb it in sufficient quantity, or to any considerable depth; whilst if it be a mere surface-covering, it is likely to be of little more use than ordinary painting, which requires to be renewed every four or five years.

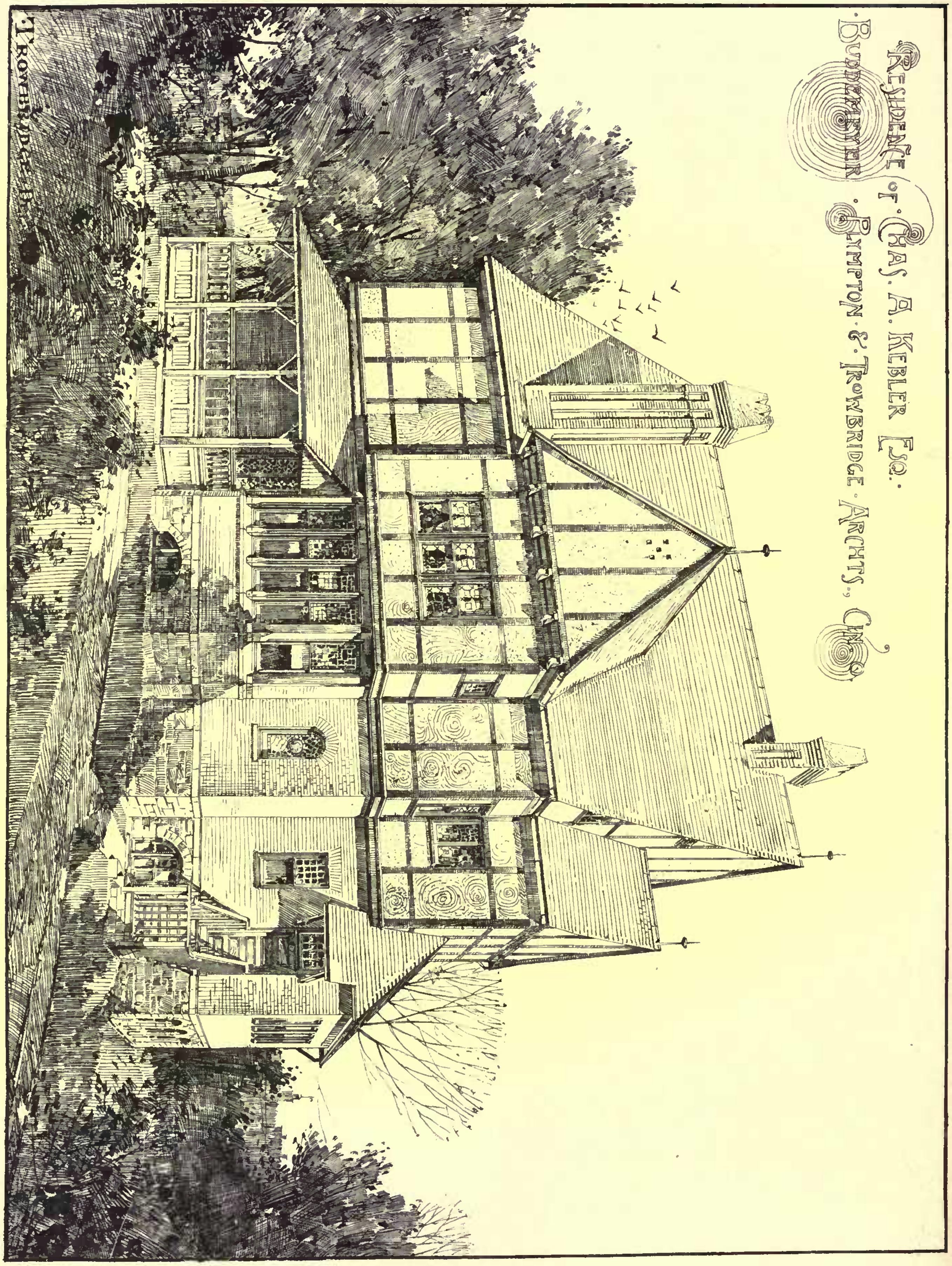
Since we know that of all the constituents of stone there is nothing more permanent than silica, and that the combinations into which this substance enters are numerous and varied, and, moreover, that silicates are capable of being readily manufactured by easy and inexpensive processes, it was natural that some solution of silica should have been amongst the first to suggest itself to the chemist as likely to prove eminently successful as an application for the hardening of stone. Accordingly we find that, as far back as the year 1826, Professor Fuchs, of Munich, proposed an alkaline solution of silica, under the name of soluble glass, for the solidification of stone. Professor Kuhlmann, of Lille, subsequently read a series of papers before the French Academy of Sciences, on the application of water-glass (silicate of potash) to the hardening of stone. The great drawback to the use of these alkaline silicates is the efflorescence to which they necessarily give rise. In order to avoid this difficulty, other methods were proposed some years later to the Commission appointed to inquire into the condition of the stone of the Houses of Parliament. Amongst these was a solution of baryta, followed by a solution of superphosphate of lime, which produced a precipitate within the pores of the stone of insoluble phosphate of lime and phosphate of baryta; another was silico-fluoric acid in conjunction with baryta, both of which processes were attended with a certain amount of success.

Limestones may also be rendered non-porous by the application of oxalate of alumina, which produces an insoluble precipitate of oxalate of lime and alumina. Any of these processes fill up the pores of the stone with material of a permanent character without giving rise to the production of soluble salts which require to be washed out. The use of organic substances, such as linseed oil, afford considerable protection for a time, but organic matter of this description is liable to be changed by combining with the oxygen of the air. In the case of ordinary painting, it is the oxidation of the oil of the paint that causes the paint to scale off in the course of a few years, the oil being converted into a brittle resinous substance. The rapidity with which gutta-percha, when exposed in thin strips to the influence of light and air, loses elasticity and is converted into a brittle material, affords a good illustration of this oxidation of organic matter. Of materials not belonging to the inorganic or mineral class, one of the least subject to any change is paraffin, and on this account the use of paraffin applied in various ways, sometimes in solution and sometimes in a melted state, has been at various times suggested as a means of preserving stone by preventing the penetration of moisture. We have a striking example of the effect of climate upon stone in the Egyptian obelisks which, after remaining unaltered for thousands of years in the dry climate of Egypt, are no sooner removed to such an atmosphere as that of London, than they begin to show signs of disintegration and decay, as is more or less the case with all the three obelisks that have been brought away from Egypt, one erected in New York, another in Paris, and a third on the Thames Embankment. Their condition is no doubt, to a considerable extent, due to injuries received whilst they laid neglected on the sands of Alexandria, and partly to such as were unavoidable in transporting them to the several positions they now occupy. The decay that has taken place in the New York obelisk appears to have been very much greater than is the case with the one erected in London. In a paper read before the New York Academy of Sciences, it is stated that exfoliation had taken place to a serious extent, pieces of considerable size becoming detached from the mass. Attempts at preserving the stone from further decay have been made both at London and New York. The method adopted in New York by the advice of Dr. Doremus, consisted in the use of paraffin, which was applied in a melted condition (mixed with a little creosote) to the stone, previously warmed by means of a small portable furnace. In this manner the paraffin could be made to penetrate to a depth of from a quarter to half an inch.

A very popular building stone in New York is that known as "brownstone," which, from its liability to decay, necessitates the use of some preservative process, and the paraffin treatment has been employed upon various buildings in New York with results that have been regarded as successful. With respect to the obelisk, however, the last reports I have seen are not in favor of this mode of treatment. Any process which involves the heating of the surface of the stone, must always be attended with considerable risk of failure.

The obelisk on the Thames Embankment has also been subjected to a preservative process, but of a different kind. Upon its showing indications of being acted upon by exposure to the atmosphere of London, the Board of Works, in 1879, under the joint advice of their engineer and consulting chemist, entrusted the task of coating it with a preservative solution, consisting essentially of a solution of gum resins in petroleum spirit, to the Indestructible Paint Company. The solution was very carefully applied after cleaning the obelisk thoroughly, beginning with a very weak solution, and repeating the application as long as the stone could be made to absorb it. So far, the application appears to have been of service, but a period of eight years is too short a time to allow of any decided opinion being formed as to the durability of such a protective coating.

[1] A lecture by W. Y. Dent, F.C.S., F.I.C., read before the Society of Arts, and published in the *Journal* of the Society. Continued from page 126, No. 611.



Heliotype Printing Co. Boston.

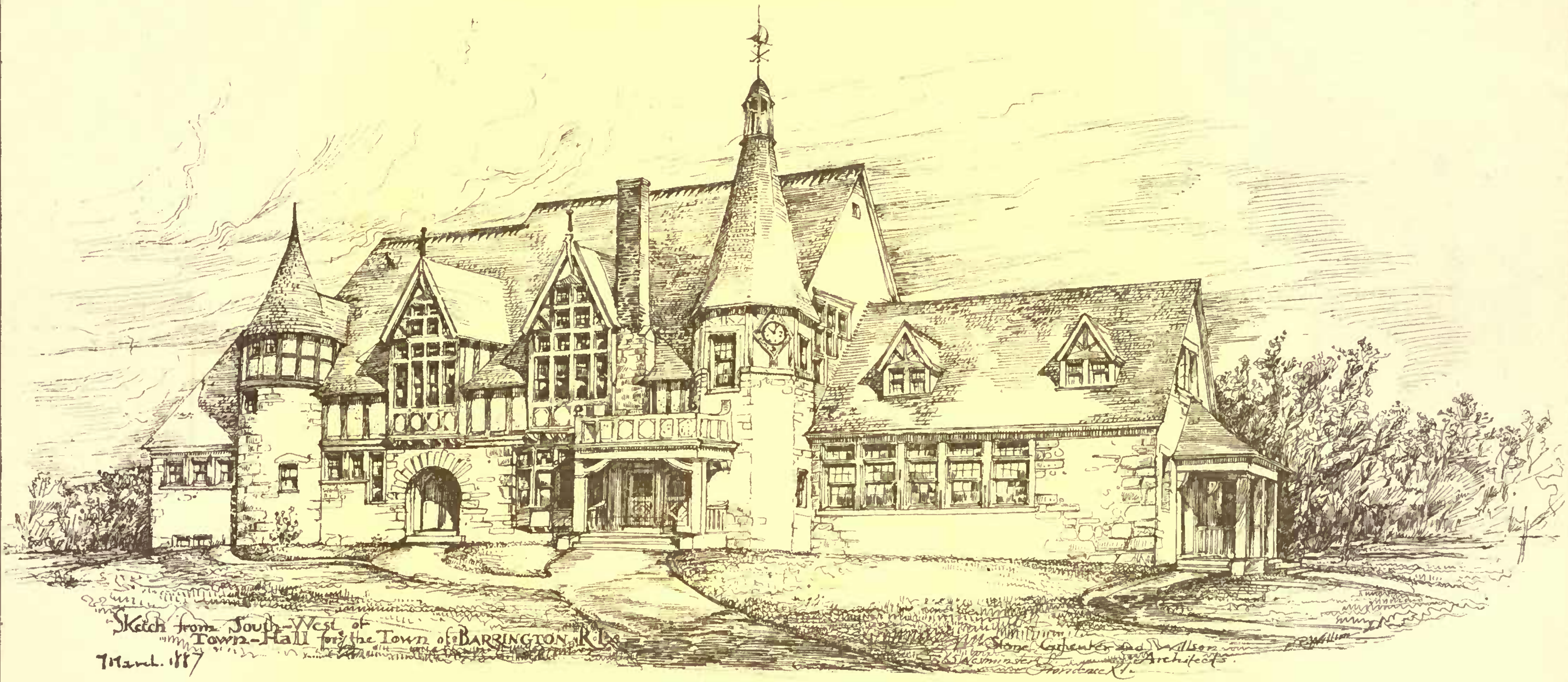


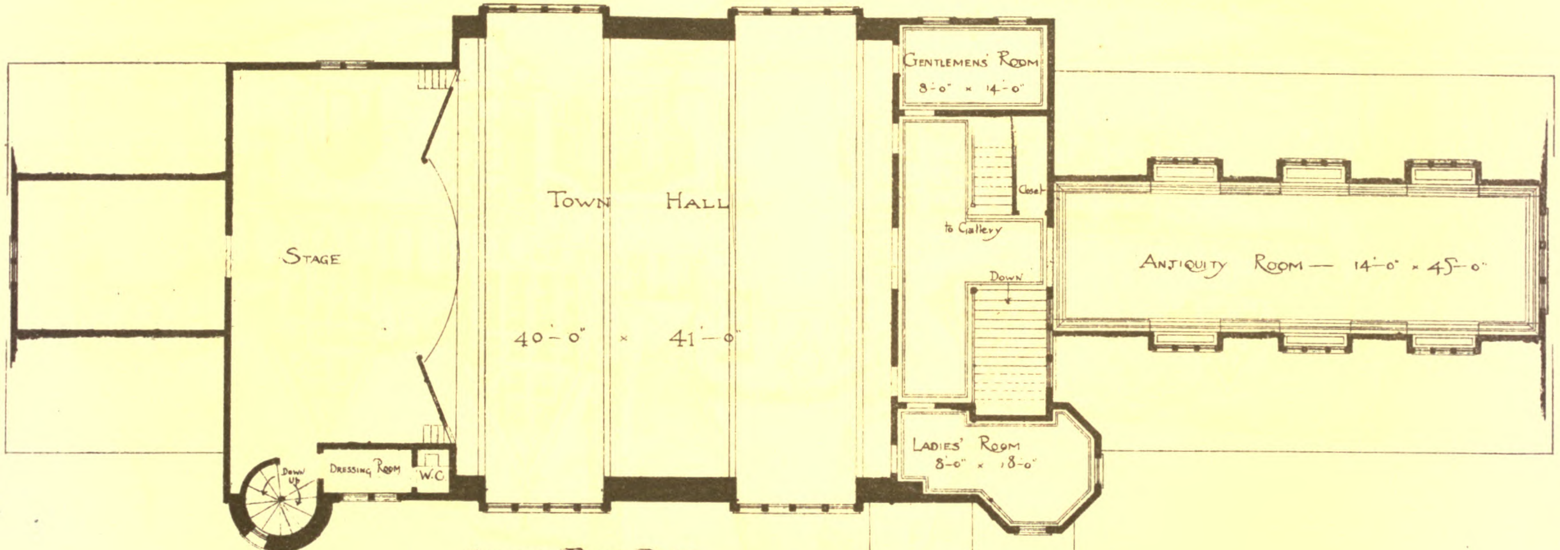
Heliotype Printing Co. Boston

Church at Cunault, France.



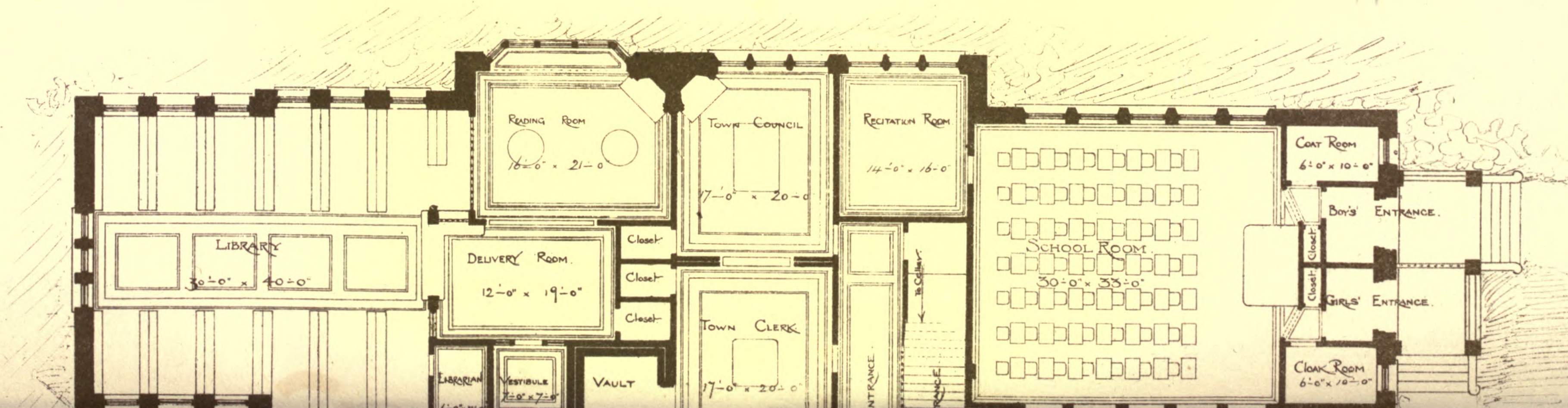
FIRST FLOOR PLAN.
SCALE 1/8TH-IN-=1 FOOT.

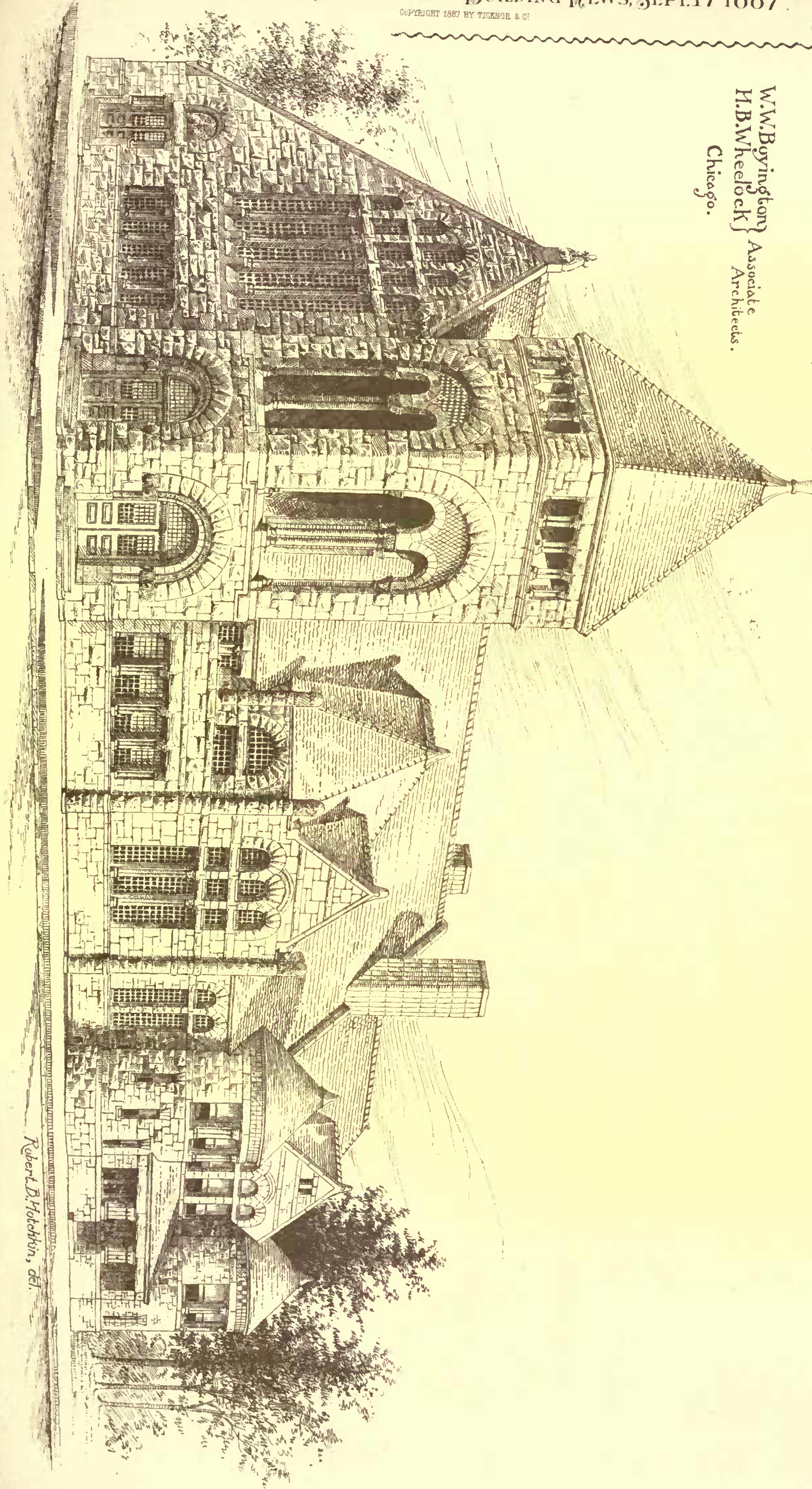




Second Floor Plan

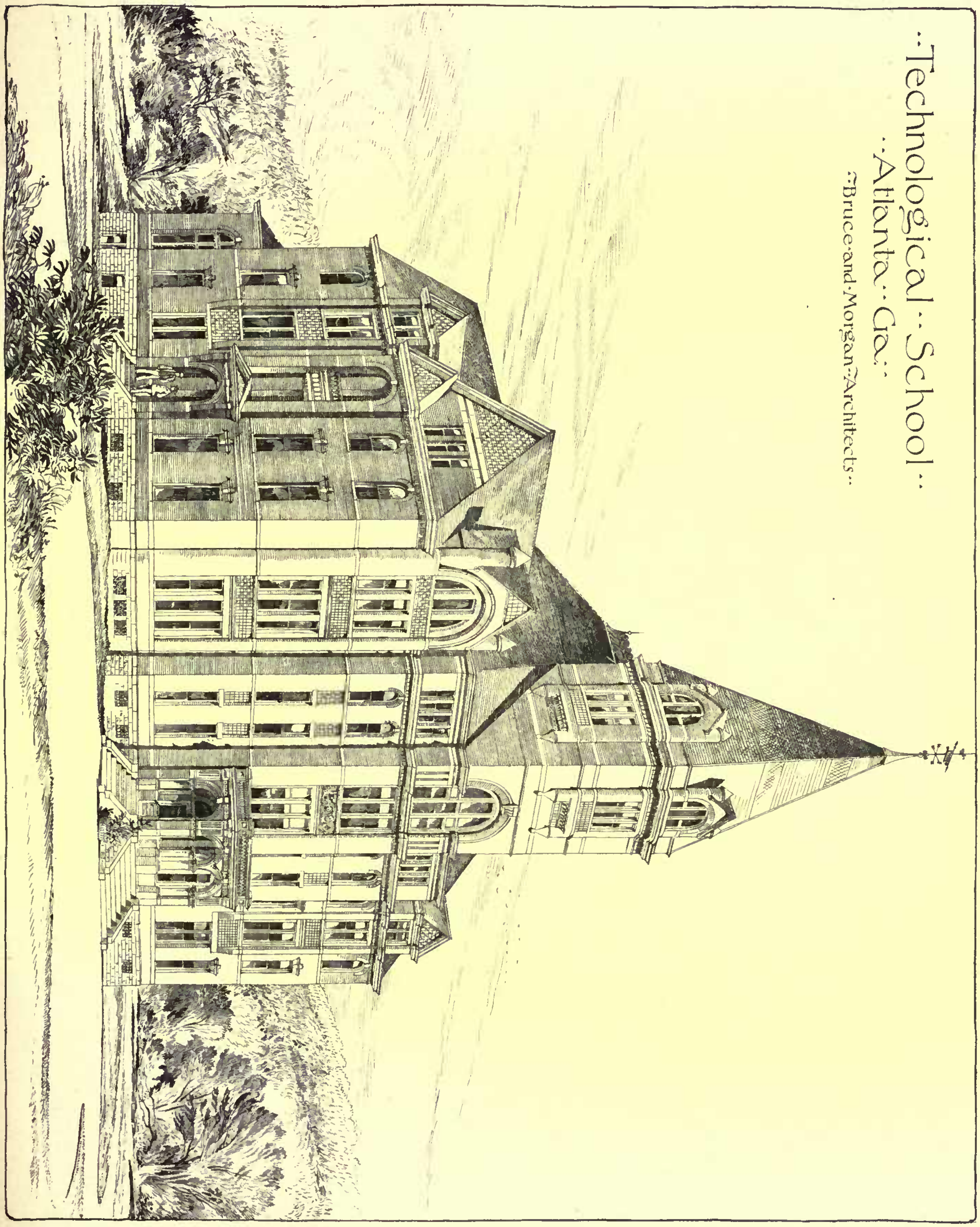
Scale 1/8 in. = 1 foot.





Kenwood Evangelical Church,
Kenwood Ills.

W. W. Boyington } Associate
H. B. Wheelock } Architects.
Chicago.



Technological School
Atlanta, Ga.
Bruce and Morgan Architects

Heliotype Printing Co. Boston.

As regards the palace at Westminster, the decay, after all, cannot be said to have affected its stability as a building; it has been chiefly confined to places underneath string-courses, or ledges, which are kept constantly damp by the rain collecting upon, and percolating through, the stone above. Some of the finials have also been broken by the rusting of the iron rods that supported them. What is now being done in the way of preservation, is to coat such projecting surfaces with mastic or cement, so as to allow the rain to flow off freely, without allowing it any opportunity for penetrating the stone, and to remove decayed and imperfect stone, replacing it with sound material.

If care be taken in the selection of stone, it is only under special and exceptional circumstances that it will be considered desirable to resort to methods of preservation, which must necessarily be expensive, and can only be regarded as the best cure for defects that admit of no other remedy.

ARTIFICIAL STONE.

The numerous attempts that have been made at different times to produce an artificial material that should be capable of being used in the place of natural stone, having resulted in the very general use of concrete, or materials in which Portland cement is the binding material. The closest imitation of natural stone is perhaps that manufactured by Mr. Ransome, who took out his first patent forty-two years ago. It was not, however, until 1856 that any successful result attended his experiments, when he found that by the use of calcium chloride, in conjunction with silicate of soda, an efficient binding material could be obtained that, when mixed with sand, would solidify into a hard mass. By the action of calcium chloride upon silicate of soda, an insoluble silicate of lime is formed, leaving a soluble sodium chloride, or common salt, which had to be removed by washing, an operation which, although apparently very simple, proved to be extremely difficult in practice. In spite of the greatest care it was found impossible to wash out the last traces of soluble salt from massive blocks, and consequently the stone was liable to be disfigured by efflorescence. This stone was subsequently prepared by an improved process, but it cannot be produced to compete with the lower price at which substitutes for stone can be made by the aid of Portland cement.

Silicate of soda is readily obtained by boiling flints in a solution of caustic soda under a pressure of sixty pounds on the square inch; or it may be obtained by simply boiling certain siliceous deposits found in various parts of the world in an open vessel. In certain strata of the lower chalk formation in the counties of Surrey and Hampshire, there are beds which contain silica in this readily soluble condition, some of which, in the neighborhood of Farnham, will yield as much as from fifty to seventy per cent of silica by simply boiling with caustic soda.

The Victoria Stone Company has for the last sixteen years been producing a very excellent material as artificial stone, especially adapted for sinks, flagstones, and landings, which is capable of competing successfully with the best Yorkshire flagging. It may be regarded as a fine description of concrete, being produced by binding together granite siftings by means of Portland cement. Their principal works are situated near the Groby granite quarries, not far from Leicester, and it is the siftings of the broken granite that are thus utilized. These siftings, after being washed, are mixed with Portland cement in the proportion of three parts of the former to one of the latter, sufficient water being added to cause the cement to set. The surface of the blocks is further hardened by being placed in tanks containing a solution of silicate of soda.

There are other kinds of artificial pavement now manufactured, in the preparation of which broken granite and blast-furnace slag are employed, but they all depend principally upon Portland cement as the binding material.

TERRA-COTTA.

During the last twenty years much attention has been paid to the manufacture of a material to be used as a substitute for stone, which, so far from being of modern origin, is associated with the very earliest history of our race. It is known by the name of terra-cotta. As regards durability, burned clay is capable of resisting the effects of time to as great an extent as any other material used for constructive purposes, of which we have abundant evidence in the specimens of Assyrian and Egyptian antiquities in the British Museum. The use of terra-cotta affords facilities for the production of elaborate designs, the clay model itself being converted by baking into a material more durable than stone. It is much lighter than stone, as compared with the crushing force it will sustain; and by the use of different clays a variety of colors may be obtained. Against these advantages must be considered the difficulties presented in the liability of the clay to shrinkage, both in drying and firing, which in spite of the greatest care and experience, not unfrequently produces distortion from unequal contraction. To the improved manufacture of this material, a great impetus was given by its being adopted to such a large extent for the Albert Hall and other buildings at South Kensington, the perfection to which it has now attained being, to a great extent, due to the energy and skill displayed by Messrs. Doulton & Co., as well as by other manufacturers. Success depends upon the use of a due proportion of the several materials employed, on the attention paid to the grinding and mixing, and to the care bestowed during the operations of drying and firing.

FIRE-BRICKS.

The plastic clays consist of silica and alumina, chemically combined with water. They are hydrated silicates of alumina, their plasticity depending upon the water that enters into their composition. The water, with which the clay is mechanically combined, can be expelled at a temperature a little above that of boiling, without detriment to its plasticity, but the whole of the water it contains cannot be driven off without raising the temperature to dull redness. Silica, alumnia, and lime are all separately very infusible substances, and are capable of resisting exposure to very high temperatures without softening. It is on account of its extreme infusibility that lime is found to be the most suitable material for the cylinders upon which the oxyhydrogen flame is made to impinge to produce a brilliant light, the intensity of the light being due to the extremely high temperature to which the lime is raised. Lime, however, from its want of cohesion, could never be brought into general use for such purposes as fire-clay is employed, and this is also the case as regards silica, which requires the addition of some substance of a basic character with which it will unite, and so cause the particles to bind together.

The nearest approach to the use of silica alone as a fire-brick is in the well-known Welsh brick, made from the Dinas rock in the Vale of Neath. This material, before it was made into fire-bricks, had long been used for repairing the furnaces at the copper works of South Wales, for which purpose its peculiar property of expanding when subjected to the influence of high temperature, instead of contracting (as is the case with ordinary fire-clay,) renders it particularly suitable, the cementation of the bricks being facilitated by the increase of temperature. In order to make bricks of this Dinas rock (which occurs in various conditions, from that of a firm rock to that of disintegrated sand,) it is necessary to mix with it about one per cent of lime. These Dinas bricks will stand very high temperatures, but they are more friable than ordinary fire-bricks, and will not resist to the same extent the action of basic substances, such as furnace slags containing much oxide of iron. The bricks are porous, readily absorbing moisture, hence it is necessary that furnaces built of these bricks should be gradually heated, the bricks being liable to crack if sufficient time is not allowed for driving off the moisture.

The composition of the clay used for fire-bricks is a question of considerable importance, inasmuch as its quality depends greatly upon its chemical constituents, although its power of resisting fusion, when exposed to intense heat, is effected by its mechanical condition. The same materials, when mixed together in the form of a coarse powder, will require a higher temperature to fuse them than would be the case if they were reduced to a fine state of division. For the manufacture of fire-bricks the raw clay is ground between rollers or under edge stones, or reduced to powder by means of a Carr's disintegrator, which consists of large cylinders constructed of wrought-iron bars revolving rapidly in opposite directions. The clay is then kneaded with water, old bricks or other fired ware reduced to a coarse powder, technically known as "grogg," being mixed with the raw clay. This admixture of previously burnt clay renders the bricks less liable to shrink, and enables them to bear a much higher temperature without fusion than would be the case if only new clay were employed. The qualities required in fire-bricks are—

1. That they should bear exposure to intense heat for a long period without fusion.
2. That they should be capable of being subjected to sudden changes of temperature without injury.
3. That they should be able to resist the action of melted copper or iron slags.

It is not to be expected that any one description of brick should exhibit all these qualities to the fullest extent, and, it is therefore essential that, in selecting the kind of fire-brick to be used, due regard should be paid to the particular purpose for which it is required.

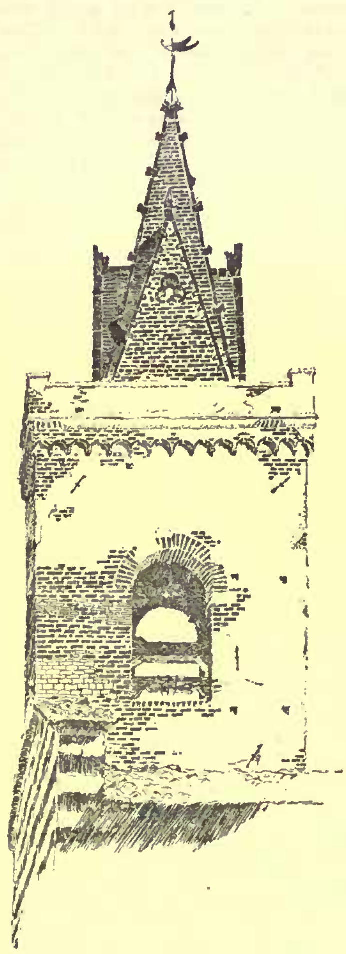
A fire-brick like the Dinas, containing ninety-eight per cent of silica, will bear exposure to a higher temperature than a Stourbridge, but it will run down sooner than the Stourbridge when in contact with melted iron slag.

Gannister is the name given to a fine grit which occurs under certain coal beds in Yorkshire, Derbyshire, and South Wales, which is especially adapted for lining cupola furnaces; the peculiar black gannister from the neighborhood of Sheffield is in great request for this purpose, as, owing to the large quantity of silica it contains (from eighty to ninety per cent), it will stand high temperatures without shrinking. The Lee Moor bricks are manufactured at Plympton, in Devonshire, from the coarser portions of decomposed granite, separated from the china clay during the process of washing. These bricks contain a large proportion of silica, and are very infusible, their power of supporting exposure to very high temperatures being increased by the coarseness of the particles of disintegrated granite, of which they are composed.

Fire-bricks are also made of silicious clays from the granitic deposits in other parts of Devonshire. The material employed for such bricks, as well as for the Dinas, differs materially in its character from what is ordinarily understood by the term fire-clay, as used in the manufacture of such well-known bricks as the Stourbridge, Newcastle, or Glenboig; the quality of which, as regards their chemical composition, depends upon the relative proportions of silica and alumnia, and their freedom from iron oxide and alkaline salts, the presence of which tend to render the clay more fusible.

[To be continued.]

FURNITURE EXHIBITION, ANTWERP.



A CAMPANILE AT PISTOJA.
From a drawing by EDWIN GEO HARDY

ON a portion of the site of the Antwerp Exhibition of 1885, a permanent *Palais de l'Industrie* has been erected, to serve for holding special exhibitions which are now so much appreciated in various countries, and which have the advantage of bringing into close proximity cognate objects that can thus be viewed by the specialist without having to wade through a vast number of possibly uninteresting exhibits. This year the exhibition is international, and embraces Furniture, Costume, Landscape-Gardening and Horticultural Implements. In connection with the third of these sections a horticultural exhibition has lately been held by the Cercle Floral, of Antwerp, Mr. Veitch, of London, Eng., being President General of the Jury. Instead of being merely exhibited on separate stands in a formal manner, the beautiful palms, fern-trees and other exotic plants were tastefully laid out in *parterres* by M. Bourland, the manager, forming a *coup d'œil*, which added greatly to the attractiveness of the exhibition generally. Moreover, the show-cases themselves are in many instances works of art, several of them being in carved oak. A very pleasing effect is given to some French and American plate — a great deal of it frosted silver — by laying red cloth on the glass top of the show-case, thus throwing a red lustre on the objects. At one end of the building, behind a bust of Rubens — whom Antwerp claims as one of her most illustrious citizens — is hung a velvet pile tapestry, made specially by Jardine & Norway, of London, for Pope Pio Nono, but not completed within the specified time. It was designed by the Swedish painter, Thorwaldsen, and represents Christ in the middle of the Twelve Apostles, each bearing his conventional symbol. The composition is not intended for near effect, but from the opposite side of the building the figures stand out in bold relief from the maroon ground. So large is the work that the value of the wool alone is $1,200, while the price asked is $5,000. Haim Vidal, of Constantinople, exhibits various Oriental carpets, including those of Smyrna, where he has a factory.

Some exhibitors show carved oak chairs, in imitation of the antique, having embossed-leather backs and seats. There are several *cheminées*, or mantel-pieces, worthy of notice, including one in white marble of Belgian design — that is to say, with returns at the sides of the chimney-breast — and having cariatydes at the corners. The fender is made of plaster-of-Paris, and the fire-irons are whitened to match. A fire-grate, in which the advantages of the close stove and the open grate are combined, has a canopy in antique *repoussé* brass after the style of the *dinanderies* (salvers), so called from their having been originally made at Dinant, the city at the confluence of the Sambre and Meuse. There are several artistic *buffets* and *étagères* of carved oak in Flemish Renaissance style, and garnished with stained-glass panels, old china, both real and imitation, and encaustic tiles.

Oak furniture in imitation of the antique is made at Brussels, Antwerp and Mechlin, at which last-named place it is now the staple manufacture, having quite superseded that of lace, so renowned of yore. The Mechlin or Malines oak furniture is noted for boldness of design if somewhat coarse in execution, and that of Brussels is distinguished by excellence of workmanship and fineness of finish, while that of Antwerp may be said to come between the two. However, Teugels-Schippers, of Mechlin, has sent an old man, "a lean and slipper'd pantaloon," carved in oak with great skill. An oak dining-table, rectangular, with corners taken off square, has the top inlaid with oak stained to different shades, which produces a good effect. De Visser shows an elegant suite of bed-room furniture in birch imitating bamboo, which is very much in vogue in Belgium just now. Among the lots in the *tombola* or lottery that has been organized in connection with the exhibition is an easy chair composed of silver-mounted lengths of real bamboo, comfortable as well as ornamental. Simon & Vivenot, of Ligny-en-Barrois, France, send a portable table and four seats called "La Lorraine," which pack into a space of 85 cm. by 18 cm. by 20 cm., or 33″ x 8″ x 7″. Expanded the table measures 85 cm. by 73 cm. by 60 cm., or 33″ x 29″ x 24″.

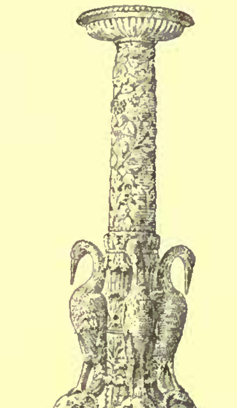
Janssens, of Antwerp, has mounted a trophy with various encaustic tiles, including some of humorous design. And Gommey, of Mechlin, has sent two views of old Antwerp executed in encaustic tiles copied from ancient models. One view of the city from the Scheldt bears the inscription "*Antverpia, urbs Belgica ad Scaldin sita, Anno MDLV*," and the other, of the Grand Place, "*Vetus curia Antverpiæ*, 1564." The artistic Linthorpe ware and Torquay terracotta for hand-painting are represented at this small but tastefully-arranged exhibition, where, also, the Oswego Company's indestructible-fibre pails, light, strong and acid-proof, also find a place. Novelli, of Florence, exhibits specimens of the beautiful inlaid marble work of that city, and Frilli, the Florentine sculptor, shows white marble statuary, including a copy of the "*Veiled Lady*," which was so much admired at the Liverpool Exhibition of last year, and was bought by Edward Legger, of *The Era*. Van Boeckel, a worthy disciple of Quentin Matsys, contributes a foliated well-top in forged iron, calling to mind that of the great painter and blacksmith near the west front of Antwerp Cathedral. A worthy pendant is the *jardinière* in cast-iron open work sent by Van Offelen, of Antwerp, and Mijnheer Dierckx, of the same city, contributes a large and handsome vase in copper, the natural color, relieved by black-iron pedestal and scroll-work, somewhat after the style of those shown for the first time at the Birmingham Exhibition of last year.

Frank Davis, of Brussels, has erected a shed to show the advantages of the transparent wire-wove roofing substance, so largely used in the railway approach to the American Exhibition now being held in London. It is a flexible, gelatinous substance, strengthened by wire-gauze, light, translucent, elastic and admirably adapted for temporary structures and rendering sky-lights unnecessary. When the somewhat high price is reduced by greater economy in manufacture, and sufficient time has elapsed to prove the durability of this new roofing substance, there is little doubt but that it will be largely used. J. Gilson sends a working model of his lift, designed on the principle of the "lazy tongs," and worked by hand or power acting through winch gear.

On September 18th will be celebrated the centenary of Joost Van den Vondel, the Flemish poet, when prizes will be awarded for the best banners of the many societies of all kinds, successors of the ancient Guilds of Belgium. On the 25th of the same month, a *fête*, organized by the Belgian press, will be given for founding a *caisse de prévoyance* or benefit fund, and on October 2d, will be distributed the prizes awarded in connection with the *Exposition d'Ameublement*.

J. W. P.

THE FATE OF GREAT ASIATIC ARCHITECTS.



MR. W. A. CLOUSTON writes as follows in a recent issue of *Notes and Queries:* It is well known that Oriental potentates in former times were wont to bestow gifts of enormous value on poets and artists whose works they admired. We often read of a rájá, sultán, or khalíf rewarding a poet for a few laudatory verses by causing his mouth to be filled with pearls and precious stones; and instances are recorded of learned men being kept prisoners by Asiatic princes in order that they should not adorn the court of any rival monarch. Many Eastern stories turn on the quest of some extraordinary object which should render its royal possessor immeasurably superior to all the kings of the earth, past and present. To the passion for the display of wealth and power are to be ascribed the numerous magnificent palaces, temples, mosques, and mausoleums erected by princes of India and Persia; but while the gifted architects were generally remunerated with riches "beyond the dreams of avarice," it would appear they sometimes fell victims to the jealousy of their royal patrons. Such was the fate of Semnar, who constructed for Nu'mán, an Arab prince, the palace of Khavarnak, if we may credit the following anecdote from the "*Heft Menzer*," or "*Seven Faces*," of the Persian Abdallah Hatifi (*ob.* A.H. 927, A.D. 1520): — "When Semnar had finished this costly edifice, so much beyond the expectation of his employer, his merits were duly appreciated and his labors crowned with the highest applause. The reward of the architect's successful skill was not confined to praise alone, for Nu'mán showered on him gifts far beyond his fondest expectations: camel-loads of pure gold, pearls, and precious stones, ambergris and musk; and all in such abundant quantities as would ensure him ease and comfort during the rest of his life. Nu'mán was well aware that he who desires to possess magnificent works of art must open wide the portals of liberality; a cook who is sparing of condiments and fuel cannot expect that the feast

will please the guests. When the architect received this unlooked-for bounty he apologized and said 'O king, had I anticipated such noble generosity, I should have bestowed greater pains on my work, and made it vastly more worthy of your majesty's greatness and munificence.' 'What!' exclaimed Nu'mán in astonishment, 'do you conceive it possible, with a larger supply of materials and a promise of higher remuneration, you could erect aught more splendid than this palace?' 'Yes, sire,' replied Semnar; 'if your majesty wished for something absolutely incomparable, I could erect such a palace that Khavarnak should appear insignificant in comparison. In this palace I have made use of but three colors; in that a hundred different tints should unite their beauty; that which is here common stone should be in the other the finest ruby; this palace has but one dome, but the other, like the ethereal world, should glory in seven.' On hearing this the king was inflamed with wrath and his countenance caused a conflagration in the stores of royal beneficence. Truly a king is a fire, from the blaze of which he only is secure who looks at it from afar. . . . Nu'mán's pride suggested that should Semnar be allowed to live some rival in power and wealth might by his means be enabled to erect a palace more splendid than Khavarnak, and he therefore commanded his attendants to put him to death. Thus did they dig up this cypress from the garden of life; his eyes were covered and he was thrown from the summit of the palace. Behold the waywardness of destiny, which made the proud monument of his skill and labor the unconscious instrument of his destruction!"

Still more horrible was the fate of the constructors of Trimal Naig's choultry at Madura, whom the Indian tyrant ordered to be thrown into a dungeon, the entrance of which was then built up, and they were thus buried alive, to prevent them from possibly erecting an edifice elsewhere which should eclipse that monument of his grandeur; and Trimal caused the two unfortunate architects to be sculptured on the walls incarcerated in a cell, which one should suppose calculated to repress the noble zeal of all future artists!

The skilful armorer who forged the sword Dham which came into the possession of the celebrated Bedouin poet-hero Antar by a lucky accident fared no better at the hands of his employer, an Arab chief. That famous blade was made from a thunderbolt that had slain one of the chief's camels, and when the smith delivered it, with natural pride, to his patron, he observed: "This sword is sharp, O chief of the tribe of Ghaylib — sharp indeed: but where is the smiter for this sword?" Quoth the chieftain: "As for the smiter — I am he," and instantly struck off the smith's head, so that there should never be another sword Dahm!

I think these stories have parallels in European legends and traditions. I have some recollection of having read, many years since, of an artist who constructed for a German prince a wonderful clock, and had his eyes put out by order of his royal employer, lest he should carry his art elsewhere and excel this complicated piece of mechanism; the artist some time after requested to be led to the clock that he might adjust something, and smiting it with a small hammer destroyed the joint production of his brain and hands.

PLATE-GLASS MAKING.[1]



FOLLOWING the order given in our table, we shall next take up the manufacture of plate-glass, and for this purpose I shall again ask your presence in Pittsburgh. This time, however, our visit will be to Creighton, some twenty miles north of the city, and near to the well-known natural-gas district of Tarentum. There are in this country four large establishments where plate-glass is manufactured. The Creighton plant has the reputation, however, of enjoying the most favorable economic conditions, and it would certainly be difficult to find in this or any other country one more completely equipped. The glass itself has the same constitution as the sheet and crown glass. It is simply a double silicate of lime and soda. The melting is carried out in large open pots, the furnaces differing in their construction from those already described only in their greater size and the substitution of doors made of fire-clay tiles set in cast-iron frames for the usual gathering holes. When the fusion has been completed, the door opposite the pot is opened, and a two-pronged fork, mounted on wheels, is inserted into the furnace. The distance between the prongs is sufficient to permit them to pass into depressions made in each side of the melting-pot, and thus secure it in a firm grasp. By this method the pot of molten glass is removed from the furnace, and is carried on a low truck to the casting-table. At Creighton, the casting-house, containing furnaces, tables and annealing-ovens, is 650′ x 160′, about four times as large as the famous *halle* of St. Gobain, in France, and nearly double the size of the British Works at Ravenhead. There are two casting-tables at Creighton, seven inches thick, nineteen feet long, and fourteen feet wide. Each is provided with an iron roller, thirty inches in diameter and fifteen feet long. Strips of iron on each side of the table afford a bearing for the rollers, and determine the thickness of the plate of glass. The tables are mounted on wheels and run on a track which reaches every furnace and annealing-oven. The table having been brought as near as possible to the melting-furnace, the pot of molten glass is lifted by means of a crane, and its contents quickly poured on the table. The heavy iron roller is then passed from end to end, spreading the glass into a layer of uniform thickness.

As rapidly as possible, the door of the annealing-oven is opened, and the plate of glass is introduced. The door is then closed, and the glass left to anneal. All of these operations are performed in little more time than it takes to describe them, as it is desirable to get the glass into the annealing-oven as hot as can be. A large number of ovens are required for annealing purposes, as the glass must remain several days to cool. When the glass is taken out, its surface is found to be decidedly rough and uneven. A small quantity is used in this condition for skylights and other purposes where strength is required without transparency. It is known in the market as rough plate. The greater part of the glass is ground, smoothed and polished before it leaves the works. The grinding is accomplished by means of rotary grinding machines, the abrading material being common river-sand dredged from the Alleghany. Three million bushels are required annually for this purpose. The plates are firmly fixed on large rotary tables or platforms by means of plaster-of-Paris. Rotating discs are so arranged that they cover the entire surface of the glass at each rotation of the platform. Small jets of water keep the grinding-sand always wet. These operations remove the rough exterior. The smoothing is accomplished by emery, finer and finer grades being used as the process proceeds. The final polishing is done by means of rouge (carefully-calcined sulphate of iron).

The monthly product of the Creighton plant is about 100,000 square feet of glass. The fuel throughout the entire works is natural-gas, which here displaces about 3,000 bushels of coal daily. It is used in melting-furnaces and annealing-ovens, as well as in supplying the steam for engines of about 1,500 aggregate horse-power. These figures will give you some idea of the magnitude of the operations connected with a large factory, and will perhaps dispel the notion, if such exist, that we are largely dependent upon France for our supply of plate-glass. The output of this factory, though so large, finds ready market and is never greater, I understand, than the demand; for the American plate-glass can compete, both in quality and price, with that of European make. At Creighton, a part of the output is utilized in the manufacture of mirrors, and improved bevelling machinery has been introduced in order to give the glass the desired finish.

[1] Portion of a lecture by Prof. C. Hanford Henderson, delivered before the Franklin Institute, and printed in the *Journal* of that society.

PNEUMATIC PARCEL-DELIVERY FOR NEW YORK.



From the Pedestal of the Washington Monument, Richmond, Va.

IT looks now as if the next great enterprise that is to distinguish New York and add to her triumphs is to be an underground parcel-express, writes Julian Ralph. Though nothing has been made public about it before this, the inventions have been perfected, the patents are taken and the company is practically formed. All our bundles are to be whirled under our feet by the agency next in speed to lightning, and the projectors expect to make a mint of money out of the venture, for they have estimated the amount of business in parcel-carrying now transacted and they expect practically to monopolize it by reason of the cheapness with which their system will enable it to be done. The pneumatic parcel-posts of London and Paris are an immense convenience and an assured success, but they are very crude and expensive, and Yankee brains have been at work for years in an endeavor to develop the European idea into something worthy of American progress and economy.

The troubles with the Paris and London systems are many, but the greatest one is that parcels cannot be sent directly to their destination on either of these lines. The London Company, for instance, maintains a ten-inch tube worked by exhausting air, and broken at certain distances for stations. If a carrier, or box, is loaded with parcels for stations C, E and G, it must stop at every station; first at A, then at B, then at C, and be sent on from each station to the next, the man at each station taking out what he

finds in it for his place and sending on the rest to the next man, and so on to the end. This is altogether too crude for Yankeeland. The Western Union Company some time ago established a pneumatic service of its own for sending messages singly or in bundles from the branch stations to the main office, and for supplying the daily newspapers with their Associated Press telegrams and special dispatches, and they carry on an enormous business with little inch-and-a-half pipes, but they overcome the clumsiness of the European system by the expensive course of using separate tubes for each station and newspaper. Of course, that offers no solution of the problem for a general public service, and the New Yorkers who have received the profit there would be in a better system inclined their experiments from the first toward a wholly automatic arrangement based on the European plan.

They saw at once that the Old World plan could be improved on by signaling along the route to have all stations closed except the one to which a box was to be sent, but that was not half enough, and they kept on until to-day they say they have reached a higher degree of efficiency in their invention than is attained by the quadruple telegraph system, whereby four messages may be sent to different places on one wire. By arranging an automatic correspondence of mechanism between the boxes and certain appliances in the tube they claim to be able to start an/ number of boxes simultaneously, each to a separate station, with a certainty that each one will go to its destination of its own accord without any signaling or delay or possibility of mishap. After all, that is no more than is done with the cash balls and boxes on the hanging tracks in the ladies' shopping stores, and not half as marvellous as the sending of messages in opposite directions on one wire by telegraph.

But that is not all. The London tubes are only ten inches in diameter, and do not carry more than twenty-five pounds each, it is said. The New York tubes will be sixteen inches in diameter, with boxes of a capacity of one hundred pounds, or sufficient to take almost any parcel that a man would be likely to carry. The projectors estimate that the shopping stores alone spend something like $100,000 a day in wagon and messenger service for delivering purchases to customers' houses, and that is outside of the smaller traffic of the same sort, the miscellaneous parcels handled by the express companies and by individual citizens, district-messengers and all the rest. And the great moral they draw for their own satisfaction is that at present, by any and all these means, it takes as long to get a parcel anywhere in town as it does to send the same thing to Philadelphia. The motive power the company will use will be the exhaustion of air, as of old, and it will employ a messenger-corps at each station to carry the parcels to the houses.

BOOKS AND PAPERS.

Anything which admits one to the private life of a great man is sure to be welcomed by the public. A biography compiled chiefly from private letters must be poor indeed which is not read with interest. Most people, who have even a fair education and average imagination, will write private letters to their friends which are always interesting, if only from the fact that they are personal. It is only when one is on his good behavior, so to speak, or when one is preparing to deliberately edify that indefinite factor, the public, that literature becomes a burden, to reader and writer alike. This is made peculiarly manifest in the recently published biography of Horatio Greenough.[1] The book is composed almost entirely of private letters from the sculptor, and is most unexpectedly interesting, considering how really uneventful his life was. Written in any other form the biography might easily have become tedious. It is the personality of the artist, the bits of private life, the half revealed inner character which give the book its value. After all, we most of us are gossips at heart, and it is a satisfaction to know that others think and act as we do on occasions, and are just as prone to indulge in the commonplace. For instance, in a letter from one of the family, we find this allusion to the youthful occupations of the man who was to become one of the first artists of the country. "Ask Horatio if he recollects his first workshop — the well-curb turned sidewise, where he and you read the '*Life of Benvenuto Cellini*'? When tired of his constrained position he would get out and fire corn-cobs at the yellow cats in the field; and do you recollect your descent from the top of the barn with an umbrella? You were boys, indeed!"

The introduction begins by stating a very good *raison d'être* for the work. "The struggles of genius to make itself known are always interesting; therefore, though suppressing many confidences in depression and elation, there is enough left so show a determination to succeed, and an honest pride in surmounting obstacles." We cannot, however, but regret that Mr. Greenough's artistic struggles occupy so small a portion of the volume, for as a history of his art-growth it is very fragmentary and quite incomplete. But possibly it is best so. Criticism or even analysis belongs more to the essayist than to the biographer, and if the book fails to more than hint at his art-life, it fully atones for the omission by illustrating his first artistic impulses, and states some facts which we dare say are not known to the majority of our readers. "When Greenough was twelve years old, Mr. Shaw, then sole director of the Atheneum, gave him access to the fine-art room, with the promise of a bit of carpet on which to cut his chalk [the material in which he then worked] whenever he wished to be there! Solomon Willard showed him how to model in clay. Alpheus Cary, a stone-cutter, gave him insight into cutting marble; and he profited by the counsels of Binon, a French artist. To Dr. George Parkman he was indebted for anatomical knowledge."

While a student at Harvard he designed the Bunker Hill Monument, making a model for it in wood which was adhered to in execution, though the internal arrangements were altered. In later life, in the course of an essay which he wrote on the subject of art, he said: "The obelisk has, to my eye, a singular aptitude in its form and character to call attention to a spot memorable in history. It says but one word, but it speaks loud. If I understand its voice it says, 'Here!' It says no more. For this reason it was that I designed an obelisk for Bunker Hill." In view of the many objections which have been found of late years not only against the Bunker Hill Monument but against obelisks in general as fitting types for national memorials, it may be well to remember Greenough's line of argument in defence of his design, which after all, is quite as logical and conclusive as any of the canons which we hear so dogmatically asserted nowadays. Perhaps the safest way in such discussions is to fall back on the old school maxim, "*de gustibus non est disputandum.*"

We know that Greenough's art life was not altogether happy, notwithstanding the numerous and important commissions, both private and public, with which he was honored. He never felt overkindly towards the Government at Washington. The money due him on his statue of Washington was not paid until some years after his death; and in a letter to Hon. S. A. Eliot, dated 1851, he says: "I am well pleased with the grounds on which the President objects to my exhibiting the group in London. My object in sending it there was not gain, but a desire (I trust excusable) to show my work to Europeans, before whom, of course, I could not expect to pass for anything more than I deserve. This desire was the more excusable if it be remembered that the first great work I executed it was proposed to throw into the river Potomac, — a proposition which I believe never would have been made had that statue been seen in England before going to America. I do not wish to lay any great stress on the crude opinions expressed at that time of such a work of statuary. Those men had not, neither could they have any adequate conception of the scope of my art, of its difficulties, or of the other productions of ancient sculptors, with whose works those of modern artists must stand or fall."

Apparently, United States Congressmen have not improved very much in their feeling for art since 1851.

That Greenough's judgment was not warped by the crude architectural ideas of his contemporaries is well illustrated by the following fragment of a letter to Robert C. Winthrop, Esq., written in 1844 as a protest against the refusal of the Government to provide adequate accommodation for his "Washington."

"In order to show you, my dear sir, how far we are from consistency in relation to expenditures of this kind, I beg you to reflect on the amount expended by Government on colonnades, — mere display of the pomp of straight shafts of stone. Compare these with the sums voted for art, and you will see how far we are from economy on the one side and true architectural beauty on the other. I do not wish to disparage the public buildings, but I have travelled much, and I know of no capital where larger amounts have been spent with less effect. The Capitol, with all its faults, is imposing, and the Post-Office is beautiful. I wish to show only that we have learned to vote columns to the tune of hundreds of thousands, while statues seem to us useless luxuries. Look, I pray you, at the Girard College! I could scarcely believe my eyes when I saw so stupendous a display of material and workmanship covering a few Quaker-looking square rooms. It was like seeing the Pitt diamond on an Indian squaw."

In reading these letters one obtains incidentally some interesting glimpses of Boston as it was fifty years ago. In 1830 a letter from his brother states the fact that there was a bachelors' ball at the Exchange, and "the rooms were lighted by gas, introduced for the occasion." And in the same letter the writer says that Greenough's father was the only real-estate dealer in the city. In another place the same brother voices the current feeling for architecture at that time. "But how inferior an art to painting is architecture, and how can we compare the one, whose object is to influence the mind, to rouse affections on subjects of the highest importance, to call forth the most refined feelings, and to imitate the beauties of Nature, to the other, which has only the 'ordinary marshalling,' as Bacon says, 'of a man's apartments and the pleasing of the eye, for its aim'? Yet architecture can be studied to advantage in connection with the other arts."

Somehow we are now strongly inclined to reverse the last statement, and say that the other arts can be studied to advantage in connection with architecture.

In 1843 Greenough writes from Washington: "Poor Morse is here with his beautiful, his magical telegraph. How he contrives to keep alive the hope that they will vote him $30,000 now, when they propose to cut down West Point and reduce the salaries in the navy, I know not."

There are some clever bits of epitomizing in a few of Greenough's letters. In one place he writes: "Dear, compact, bird's-eye,

[1] "*Letters of Horatio Greenough, to his brother, Henry Greenough,*" with biographic sketches and some contemporary correspondence. Edited by Frances Boott Greenough. Boston: Ticknor & Co. 1887.

cheap, quiet, mind-your-own-business, beautiful Florence, how does my heart yearn for you! There stand your bell tower and your Palazzo Vecchio. What care I for those who inhabit you? There will I build my church!" Could anything be more vivid to describe that delightful city? And again, writing of Vienna: "This town is clean and well paved, and impresses a stranger very much, with the imposing avenues, the huge public establishments, and the evidences of a great metropolis. The houses are not nice inside. The Government broom cannot reach beyond the front door, and the people are not neat in Germany, — at least, not here. The monuments are below mediocrity, the architecture rococo. The cooking is admirable; the puddings and pies all that one could desire, the fruits delicious. Smoking is universal, and the language infernal."

Altogether, the book is an interesting and valuable addition to our biographical literature; while the letters, though somewhat lacking in real information about the art-life of the sculptor, are well selected and very readable.

SOCIETIES

ANNUAL CONVENTION OF THE AMERICAN INSTITUTE OF ARCHITECTS.

THE Twenty-first Annual Convention, A. I. A., will take place in Chicago on Wednesday, Thursday and Friday, the 19th, 20th and 21st October ensuing.

In advance of the detailed programme which, as soon as some points in abeyance are decided, will be issued by the Committee of Arrangements — Messrs. W. L. B. Jenney, E. T. Littell, Henry Lord Gay, and the Secretary — the undersigned wishes betimes to call special attention to the occasion, which promises to be one of great interest and enjoyment. The architectural development of the great City of the Lakes, particularly perhaps, in its business buildings, has of late years been very notable; and will be seen under the best auspices; the Illinois State Association of Architects having passed a resolution expressing its "great pleasure in extending to [us] a hearty welcome," and having appointed a committee to act in concert with a corresponding Committee of the Chicago Chapter of the Institute "in providing a suitable entertainment to the invited guests."

The Western Association of Architects have appointed their President, Mr. Root, their Secretary, Mr. Alexander, and their ex-President, Mr. Adler, as their representatives at our Convention: and on a recent official occasion, the first alluded to it as one "which may pave the way to some possible union of the two associations, which will be a benefit to all," and the last as "an occasion which we may hope to see bring the Institute into closer relations with the Western Association, possibly resulting ultimately in both associations forming under one organization."

The Secretary has been in correspondence with some of the most prominent practitioners in the country in reference to getting brief practical papers, treating of important buildings or other architectural subjects with which their experience has rendered them familiar, and has already the promise of several. In addition to these there will be presented the opening address of President Thomas U. Walter, LL.D., the annual reports of the various Chapters, and of the Board of Trustees, and Standing Committees, as well as several proposed amendments to the by-laws, and other routine matter.

It is proposed also to collect illustrations of the works of members, for exhibition, first at the Institute Convention, and afterwards — by request of the Western Association of Architects — at their Convention in Cincinnati, opening 16th November ensuing. The illustrations may include any form of rendering: whether drawings, photographs, photogravures, or the results of any other of the various processes in vogue, and whether in whole or in part of the work delineated, but only such as represent work executed within the last ten years are desired.

The undersigned will be glad to hear, at the earliest possible moment, from members as to what illustrations they propose to send; as, also, from those to whom he wrote under date of 10th August, in relation to the professional papers before mentioned; and, in view of inquiries made by some of the latter, he wishes to repeat that a short paper will be preferable to a lengthy one: and, that when there is only leisure for a mere statement of the paramount requirements of the subject suggested, it will be entirely acceptable; nor is it essential that the papers be forwarded before October 12, though it will be convenient to have them earlier.

Referring to his letter, also of 10th ultimo, to the Presidents and Secretaries of the various Chapters, the undersigned begs to remind them of the suggestions therein made.

Any reports or communications for the Committee of Arrangements, which cannot be mailed in time to reach the Secretary, in New York, by October 15, may be forwarded to Mr. H. L. Gay, 15 East Washington Street, Chicago.

A. J. Bloor,
Secretary, A. I. A.

COMMUNICATIONS

A DISPUTED COMMISSION.

To the Editors of the American Architect: —

Dear Sirs, — We write to you relative to certain decisions which may have been rendered from time to time. We have a case now in the Circuit Court pending which we brought against a client, as follows: We made the preliminary sketches and studies for a person for two houses, but we had no written contract, simply a verbal arrangement. The sketches for the one house were, however, accepted, but before we commenced the drawing he found some other person who proposed to make the drawings cheaper than we had agreed to do it; therefore he delivered to them our sketches, and they went ahead (and copied our sketches), and made the drawings. Upon learning these facts we presented our bill, payment of which was refused, and hence we brought the suit and got a judgment for the full amount claimed, and he appealed to the Circuit Court, and we shall be pleased to get a decision. Now we want to make the best fight we can, and if you have any knowledge of any reports of any decisions having been rendered, we shall be under obligations to you if you will cite them to us. We shall be pleased to hear from you at an early day. Very respectfully, X and Y.

[We do not know any recorded cases similar to this, and hope to be fully informed as to the result of the appeal. — Eds. American Architect.]

NOTES AND CLIPPINGS

A Case of Spontaneous Combustion. — One of the most curious instances of spontaneous ignition on record is that recently reported to *The Iron Age* by a Chicago manufacturer of plane bits. For some time a sponge had been used for wetting an emery-wheel in his shop, bringing water up out of a water-box by capillary attraction, and touching the wheel. It was kept against the wheel lightly by a spring. The wheel was used in grinding very hard steel plates, therefore the sponge constantly wiped particles of steel off the wheel during its revolutions, and it was used in that way until these particles had filled up its cells to a very considerable degree, of course being wet all the time. It was then laid aside, the string being still attached to it together with a little cotton cloth. In time it became entirely dry, lying on and against a couple of pieces of fine wood. After lying unobserved for a week or ten days, it was suddenly discovered one afternoon to be incandescent — in fact, a living coal — and to have set fire both to the board on which it rested and the one against which it leaned. It had burned a considerable portion of the stout twine and the cotton cloth attached to it. All were smouldering, and although flames had not burst forth, they evidently would have done so in a short time, as the room contained a very pungent smell of burning wood. The boards were each burned to a depth of a quarter of an inch and to a width approximately three inches when the incipient conflagration was quenched. The appearance of the charred sponge was not much unlike that of a piece of roasted iron ore, which it differed from, however, very decidedly in weight, being quite light. When broken it exhibited the same characteristics throughout, showing that the fine particles of steel had been thoroughly distributed in its interior. This evident case of spontaneous ignition of an article which had not been saturated with grease or oil, but which consisted of a piece of ordinary sponge, filled with fine particles of steel while it was in a wet state, naturally caused much discussion, but a very plausible explanation of its mysterious behavior has been made by the manufacturer himself, as follows: The particles of steel which were wiped off the emery wheel by the sponge must necessarily have been exceedingly fine, as the steel was very hard. Lodging on the sponge in a wet condition and in constant contact with water, oxidation was active — or, in other words, the particles rusted very rapidly. The fine particles of steel presented an extremely great surface area for such action as compared with their bulk. Under ordinary circumstances, oxidation does not develop sensible heat, but under the peculiar conditions here realized, the usually harmless chemical phenomenon of rusting developed into an actual fire-creating agent, and incandescence resulted. Here was an article which at first sight would seem to be as incapable of spontaneous combustion as an ordinary brick, but which proves to be entitled to rank with greasy rags and oily waste, and other well established fire-creating combinations. Had not this burning mass been discovered most auspiciously, a serious conflagration would, in all probability, have ensued, and its cause would have been "unknown." — *Fire and Water.*

A Moscow Theatre Fire. — "For marines" and others a writer in the Vienna *Allgemeine Zeitung* describes the following possible episode in the life of Colonel Sudeikin, the St. Petersburg Chief of Police, whose assassins were but recently sentenced to death. "On a Saturday in the first weeks of the year 1883," he writes, "'La Périchole' was performed in the Demidoff Theatre at Moscow. I had a seat in the first row, directly behind the orchestra, and next to me sat a police officer who seemed to know everybody. It was Colonel Sudeikin, a handsome young man of elegant appearance, whose faultless military dress was very becoming to him. A singer had just finished the famous romanza of the letter when a flame was seen to shoot up between the wings on the left side. 'Fire!' I called to the police officer. 'We are lost, sitting as we do behind the orchestra, far from the exits, in this wooden structure.' 'Don't budge,' he called, drawing a revolver with one hand and violently pressing my arm with the

other, simultaneously jumping upon his seat. Menacing the crowd with his weapon, he called in a voice of thunder: 'In the name of the Emperor, let everybody remain in his seat!' And now I witnessed a most remarkable scene. On the one side there was a stage wrapped in flame and smoke, on the other an immovable mass of people, chained to the ground by the word of a single man who had invoked the magic of the Imperial name. All this had occurred with the rapidity of lightning, for that courageous and cool-blooded man knew well how precious every moment was. '*Garodovoi*,' he called to the policeman guarding the doors, 'assist the audience out!' Then, one after the other, those whom the *Garodovoi* touched with the fingers, rose and left. Boxes and rows of seats were emptied almost noiselessly. Behind us, who stood with our backs to the stage, musicians and actors had long ago fled, and above us the ceiling was burning. I was seized with a desire to flee, but as a Frenchman I did not want to show less courage than the Russian police officer; and I was, moreover, convinced that, had I made the attempt to save myself, he would have shot me down as he would have shot any one else — a surmise the correctness of which I learned from him the next morning. When we finally reached the door the theatre had been emptied so quietly that it was possible even to remove coats and furs from the cloak room into the open air. At the moment of our leaving the officer preceded me saying: 'As a stranger you may have the honor of having been the last to leave the building.' The whole occurrence which to me seemed endless, had lasted barely ten minutes. A quarter of an hour later the flames had completely devoured the theatre."

Blunders of Famous Artists. — The French artist whose picture in the last *Salon* showed the eccentricity of presenting a cavalier of the time of Louis XIV, armed with a modern revolver, was not alone in his anachronism. Some of the early painters were amusingly careless about such matters. Tintoretto, in a picture of the Children of Israel gathering manna, represents them as having taken the precaution of arming themselves with shot-guns. When Cigoli painted the aged Simeon at the circumcision of the infant Saviour, which picture is now in St. Petersburg, he remembered that aged men wear spectacles, and so placed these conveniences upon Simeon's nose. In a picture by Verrio, of Christ healing the sick, the bystanders are represented with periwigs. This ludicrous effect is equalled in Albert Durer's picture of the expulsion of Adam and Eve from the Garden of Eden by an angel wearing a flounced petticoat. The same artist, in his scene of Peter denying Christ, depicts a Roman soldier quietly enjoying a pipe of tobacco. Of all the artists who have sinned against propriety or probability the Dutch and Flemish have been among the most eccentric. In the Museum of Vienna there is a picture, "Christ Bearing the Cross," by Peter Brueghel the elder, which shows Christ carrying his burden, while a monk, crucifix in hand, exhorts the two thieves to die repentant. David Teniers, the younger, in his "Denial of St. Peter," in the Louvre gallery, represents Peter as a Flemish guardsman. The soldiers are playing cards at a table and the whole scene is thoroughly Flemish. A Dutch painter in a picture of the Wise Men worshipping the Holy Child, has shown one of them wearing a large white surplice and boots and spurs, and in the act of presenting to the Child a model of a Dutch man-of-war. Another Dutch artist in representing Abraham offering up his son, departs from the Scriptural account of the patriarch's "stretching forth his hand and taking the knife," and shows him as about to shoot Isaac with a blunderbuss. Jean Belin, in one of his pictures, represents the Virgin and Child listening to a performer upon the violin, and in another he has drawn King David playing upon the harp at the marriage of Christ with St. Catharine. Nicholas Poussin has represented the Deluge with boats at hand ready for use, and on another canvas, "Rebecca at the Well," is seen with Grecian architecture in the background. And in a picture representing "Lobsters in the Sea, listening to the Preaching of St. Anthony of Padua," the lobsters are red; although as yet, it is fair to presume, unboiled. A French artist has depicted the Lord's Supper, the table being ornamented with tumblers filled with cigar-lighters; and the Virgin Mary, in another work of the same nationality, is helping herself to a cup of coffee from a chased coffee-pot. But, drollest of all blunders is that which portrays the Garden of Eden with Adam and Eve in all their primeval simplicity, while near them, in full costume, is seen a hunter with a gun shooting ducks. The time for these absurdities on canvas has passed away. Nowadays the painter is severely archæological, and the exceptions to the rule of accuracy in such matters are infrequent. There were no art critics to swoop upon the old painters and expose their historical shortcomings in the newspapers, but woe to the artist of to-day who makes a mistake of a century or so in the details of his picture. He will be sure to see his blunder set forth in print and be smartly lectured for his ignorance. — *New York Mail and Express.*

The Gas-engine in Europe. — For large power, gas-engines are taking the place of steam-engines in some localities in Europe. It is stated, for example, that the works of Deutz, where Otto's gas-engines are being built, have for some time past employed large motors of this class for driving mills and factories, instead of the usual steam-engine. These gas-engines are used in connection with a special gas-making plant, and it is stated that whereas the average consumption of an ordinary steam-engine is three-and-one-fourth pounds of coal per horse-power, the corresponding consumption of the gas-engine is found to be not in excess of two-and-one-fourth pounds — a degree of economy which has induced several establishments to replace their steam-engines by large gas-engines. Among these works are the zinc rolling-mill in Oberhausen, where ten gas-motors supply an aggregate of two hundred and forty-four horse-power; the Mechern Berg Werk Verein, where seven motors supply an aggregate of one hundred and seventy-four horse-power; the Prussian company for the manufacture of powder in Schlusseburg, where seventeen motors supply an aggregate of one hundred and ninety-four horse-power; a sugar factory in Elsdorf, where six motors supply an aggregate of one hundred and ninety-one horse-power; and there are several municipalities which have resorted to the same means for public purposes. — *Boston Transcript.*

Theatre at Buenos Ayres. — Buenos Ayres is to have a large theatre, covering 13,000 square metres of ground, which will contain 112 boxes and three galleries, and accommodate 4,000 spectators. The stage exclusive of the proscenium is to be forty-five metres deep, almost rivalling that of the Scala at Milan. The cost of the building is estimated at $3,000,000. A model constructed by the engineer Ciachi of Milan has been shipped to the President of the Argentine Republic. — *New York Evening Post.*

A New Use for Old Bricks and Mortar. — A builder in Newburg, N. Y., who is tearing down a building to make room for a new one, is putting the old brick and mortar of the building to a novel use. He has contrived a grinding machine, into which he feeds the old brick and mortar, and it is ground into powder, or rather into building sand and cement, and the material will be used in setting brick in the new building. — *Boston Journal.*

TRADE SURVEYS

The volume of business for August was the largest ever known, and for the eight months of this year the excess is stated to have been eight per cent over the volume of the same eight months last year. An enormous distribution is in progress, and it is not believed that it is in excess of actual requirements, or in excess of the capacity of consumers to pay. There is a little unsettled feeling in some quarters over the possibility that the jobbing interests may be encouraging or forcing a larger distribution than the country is ready for. A few really unimportant failures have given rise to this fear. Trade conditions are everywhere favorable. Petroleum is threatened with an advance because of a ten per cent falling off in production, which may be followed up by an organization of producing interests. The decline in the wool clip will not seriously affect textile interests, though a great outcry has been made by many manufacturers of narrow margins. The textile interests are prosperous. The distribution of products is very heavy. Stocks are light. Mill-capacity East and South is steadily increasing, and the winter and spring outlook is quite favorable. The coal markets all over the country have developed considerable activity this September. The anthracite production is gaining over last year. Western demand is particularly active. The newly-developed sources of supply are doing well, and a speculative feeling in coal territory is apparent, especially in territory adjoining new or projected railroad lines. The increased manufacturing activity is stimulating the fuel demand, but prices remain low, and no fluctuation is probable under the influences which now control the production and distribution of either anthracite or bituminous. The iron trade is vigorous, and prices are stationary. Crude output has returned to the spring limit. Mill consumption is higher than it has been for years. Merchant steel demand is very heavy. Car-making contracts are being scattered around freely, and all works are full. Locomotive-building is more active than a month ago. New roads are providing for capacity and rolling stock, and old roads are also heavy purchasers of not only engines and cars, but all manner of equipments. The American railroad managers are, as fast as they are able, imitating the example of English managers, and are doing their work more thoroughly, regardless of the greater expense. The projected railroad bridge work is out of all proportion to the projected work at former like dates. The bridge builders, however, find foreign beams creeping in here and there.

The extraordinary consumption of lumber has enabled manufacturers everywhere to maintain somewhat more remunerative prices than last year. The supply is equal to demand, but no more. Much money is tied up in lumber, and because it is in strong hands instead of in a multitude of weak hands, prices will continue firm. High prices are an impossibility in the nature of the case. Contracts for about twelve thousand cars will be given out within sixty days. Such an item as this, along with many others, helps to sustain lumber-trade prices. The lumber mills are very busy. Yellow pine and all hardwood shipments are increasing. Planing mills are also crowded, but prices are very low in most localities. Hardwood exports to Great Britain are falling off, but to South American ports are increasing. The American Forestry Congress convened this week in Springfield, Illinois. The latest reliable statistics concerning building operations in cities or towns are gratifying. The new lists of permits are large. Large buildings are projected, such as church, bank, railroad, and manufacturing establishment work. The higher prices for labor, material and money may be exerting some influence in retarding operations, but it is scarcely correct to attribute the greater display of conservatism to that cause. It would be premature to say that the rush of building is over even in the Eastern and Middle States. Evidences are not wanting that even here the activity will continue through next year. The great body of the people yet living in other people's houses have no other ready way of investing their earnings which have been enabling savings institutions and building and loan associations to make such favorable reports for years past. Nothing but a general and absolute panic will check the house-buildiog fever or the construction of the great multitude of buildings which follow in the wake of industrial prosperity. The bettering of the condition of the masses will engage attention, and more and better house room is the greatest present necessity after comfortable subsistence is provided. Many do not give this movement in house-building full credit. The housing of the world's workers is the problem in hand, and they will ask no one's permission to do it. Investors who are shrewd enough to measure the strength of this desire will place their money in this channel, due regard being had for locality and all surroundings. In a comparatively brief period it will be as rare to discover a worker under a roof not his own as it now is to find him under his own roof. A house-building era is at hand that will not be interrupted by any cause. The prosperous building and loan associations will assume a more organized shape, and soon act together instead of as now in an isolated manner. The architects repeat their favorable predictions, and anticipate an unusually busy winter in preparation for next year's work. Builders have been remarkably busy in the West, and are engaged up to the close of the season. Real estate is not climbing to impossible prices, and town and city properties can be purchased at reasonable prices. The application of electricity as a motive-power to street cars is helping to simplify the problem of cheap and comfortable living by providing quick and cheap transit between distant points. The electricians are making rapid progress in practical directions, and are deserving the thanks of the practical men who are turning their success to such practical account, within the means of the great body of the people.

THE AMERICAN ARCHITECT AND BUILDING NEWS.

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CONTENTS

THE week has produced some curious incidents in trade-union matters, but, happily, none of a serious character. In one case, in Middletown, N. Y., a Mr. Smart undertook to build a factory, and hired bricklayers and masons. A part of the work consisted in the construction of melting furnaces for glass, and Mr. Smart, being thoroughly familiar with the proper mode of laying the fire-brick around such furnaces, and wishing to have this important part of the masonry done in the particular manner that he preferred, took up a trowel and began to lay a few bricks. Immediately an uproar arose among the masons and bricklayers, who informed their employer that they would not work with a "scab," meaning himself, and threatened to strike in a body unless he laid down his trowel at once. In the other case, a walking delegate of the Carpenters' and Joiners' Union was brought into court in New York, charged with having deprived Robert Hoff, a journeyman, of work. It appeared that Hoff had belonged to the Union, but had for some reason incurred a fine, which he refused to pay. He was thereupon expelled from the Union, and the walking delegate were set upon his track to persecute him. He was at work in a large shop in Twenty-eighth Street, where the delegate found him, and his employer was notified to discharge him, under pain of having all the rest of his men called out if he refused. He resisted for some days, but was at last compelled to ask Hoff to give up his work until the matter could be adjusted; and Hoff thereupon entered a complaint against the delegate. The case was called before Judge Gorman, who explained the law of New York to be that a walking delegate had no right to go to an employer and threaten to deprive him of his men unless he would discharge a particular workman, although the delegate had, as he said, "a perfect right to go among the men belonging to his Union, and arrange with them to stop work." Even this liberal privilege did not, however, appear to satisfy the delegate and his counsel, who will probably appeal to a higher court. We hope that the superior tribunal will still further abridge the activity of walking delegates, by setting some limit to the arguments which they may use in reasoning with their men on the subject of particular "scabs." If it is illegal and criminal to coerce an employer to dismiss an obnoxious person by threatening him with the loss of his other men, we cannot see how it is any less so to procure the same result indirectly by forcing the Union men to threaten their employer with the loss of their services. The real wrong is in the persecution, not in the technical process of carrying it on, and the law which is so careful of people's interests that it will not allow even true stories about them to be circulated to their detriment ought to be able to find some way of preventing an emissary from a secret and irresponsible tribunal from following a man about, and conspiring with his fellow workmen, whatever their affiliations, to deprive him of his living.

AN International Exhibition of Science and Industry is to be held next year in Brussels, and we are requested to communicate to our readers an invitation to take part, especially in that section which is to be devoted to engineering, architecture, and materials of construction. For each section a list of subjects to which it is intended to pay particular attention is furnished, and the list in the section of architecture presents problems of unusual interest. As might be expected from a Belgian Committee, the first set of problems offered is devoted to workingmen's houses, and contains in itself some excellent suggestions. The list begins with a programme for a group of industrial dwellings of various kinds, comprising houses for foremen, overseers and ordinary workmen, arranged with the idea of bringing these classes of persons into frequent and friendly contact. Beyond this point the details of plan are left to the designer, the directions stipulating only that the houses shall be arranged with strict economy, so that the rents may be low; and that an effort shall be made to give the groups a picturesque and cheerful air, so as to avoid the impression of dismal monotony presented by most collections of houses built for workingmen's use. The next problem deals with lodgings for unmarried workingmen in large cities, and the design is to present plans for a large house, to be divided into rooms arranged for this purpose; and the third calls for a somewhat similar structure, for the temporary accommodation of men whose families live in the country, but whose work calls them to the city for days or weeks at a time. This last, which is to us a novel problem in social science, seems to be particularly interesting and useful. With us, particularly, where city rents are enormously high, as compared with those abroad, while small lots of land in the country, and materials for building, are extremely cheap, the provision of clean, comfortable lodgings at twenty-five cents a day, which would be a fairly remunerative price, would enable many thousands of sensible and prudent men to establish their families in little houses of their own, in the pure air, and among the sweet surroundings of the country, and at the same time live themselves near their work during the business week, at a total cost which would not exceed that of a miserable, filthy tenement in the city; while, if work should fail for a time, the country cottage would always be ready, with no rent to pay, and the opportunity for utilizing the unexpected leisure in cultivating the little garden, and so providing subsistence for the family until better times.

THE next problem proposed for architects to solve is not entirely new, but has, of late, come very much into prominence. Several of the best-informed authorities, and, among others, one of the celebrated Siemens Brothers, have expressed their opinion that modern industry was tending by degrees to the breaking-up of the factory system, and the establishment of small workshops, carried on by one or two persons, or by the members of a family in a room of a private house. So far as can now be predicted, this substitution of small shops for factories will improve the condition of those who work in them, and the tendency is to be encouraged; and the managers of the Brussels Exhibition invite plans for houses adapted to the use of what they called "room workmen," (*ouvriers en chambre*), including, as matters of special detail, the study of methods of introducing motive power, derived, where possible, from some general supply of compressed or exhausted air, water under pressure, or similar sources of energy; together with analogous methods for producing and distributing among the little workshops and houses in the most economical way, light and heat. To all appearances, this very problem is destined to be one of the most important practical subjects of study of the future; and there is a good deal of credit to be obtained by a successful solution of it. Still more problems of working-people's houses are proposed, relating to dwellings of fifteen to twenty-five feet frontage, such as are built for such occupants, but with the requirement that they shall be picturesque and comfortable, as well as economical; and, finally, plans are invited for small hospitals, for "crèches" or public nurseries, for a small orphan asylum, for a convalescent hospital for children, and several other establishments of the kind; as well as for a railway station, a music hall, and a crematory. We do not learn from the communication sent us just when the Exhibition is to open, but further particulars can, without doubt, be obtained by addressing the Comité Exécutif, 22 Rue de Palais, Brussels, Belgium.

AN important industry has sprung up within a few years abroad in the manufacture of roof-tiles, made in various patented shapes in a machine, which moulds them with interlocking edges, so that they make a perfectly tight roof, with

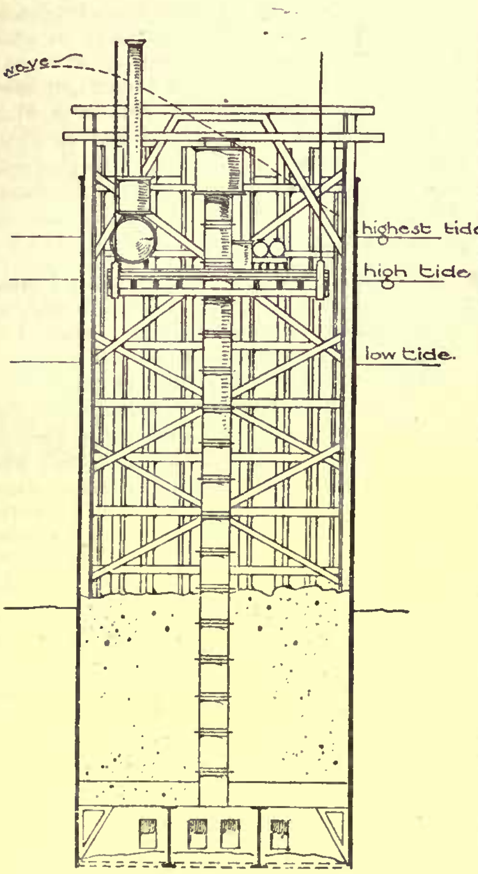
a lap of one tile over the next of less than an inch, in place of the six inches or so necessary with the ordinary pattern. A roofing-tile of this type, the Akron Diamond Tile, is manufactured in Ohio, but we know of nothing else of the sort made in this country. In our experience, the Akron tiles, although beautifully made, and of excellent material, are thin, and rather apt to break across if too tightly nailed, or shaken by the wind, leaving a bad leak in the roof; while the French and German tiles of the kind are now not only made large and heavy, but are reinforced in the middle, the thickness varying from three-eighths of an inch near the edges to more than an inch in the middle, so that transverse fracture is hardly possible. When properly glazed, such tiles are very durable and cheap, the cost of one of the best French patterns being considerably less than three cents per square foot, and they are not only used very generally at home, but are exported in immense quantities, more than two hundred million, valued in the invoices at about four and one-quarter million dollars, having been sent out last year from the port of Marseilles alone. When used in the place where they are manufactured, it is very common, instead of glazing them, either with a "slip" or a vitrifiable glaze, to dip the cheaper qualities, after heating them, in melted tar. This coats them with a black varnish, which penetrates into the pores, and makes them thoroughly waterproof at small expense. Besides this tarry black, which appears everywhere on the roofs of cheap buildings on the Continent, we have seen tile-roofs in France whitewashed; and in Germany and Switzerland brilliant-colored glazes are used, often arranged in such a way as to cover the roof of a church or other large building with a lively pattern. We do not know how much more such things would cost here than in Strasburg or Lyons, but at two and one-half or three dollars a square they would form a much cheaper roof-covering than slate, and, judging from the claims made by their manufacturers, ought to be tighter and more durable. For buildings exposed to fire they are acknowledged to be far safer than slate, which cracks off when cinders fall upon it; and, from an artistic point of view, they offer a richness of color, and an air of solidity and comfort, which no other ordinary roofing material can approach. We must acknowledge that we can imagine more beautiful designs than those which are given to the reinforcing projections in the middle of the tiles by the manufacturers whose catalogues we have seen, but it may be reserved for some American to lead the way to a perfectly artistic treatment of the subject.

M. A. VERNEUIL has recently made a study of the chemical properties of the well-known luminous paint, and a paper prepared by him was read before one of the late meetings of the Academy of Sciences in Paris and is quoted in several foreign journals. The commercial luminous paint is a sulphide of calcium, made by treating with sulphur the lime obtained by burning shells of a certain species common on the English and French coast. These shells furnish a lime which, though nearly pure, produces a much more brilliant light than can be obtained from mineral lime under the same treatment. The difference in the results is usually explained by saying that the organic matter in the shells aids the phosphorescent effect, and the known phenomena of phosphorescence exhibited by the decomposing tissues of fish and animals, together with that of many living fishes, give a certain plausibility to the theory, but M. Verneuil, perhaps reflecting that the process of calcination would remove pretty thoroughly the traces of animal matter from the shells, preferred to test the matter by the light of science, and made a careful analysis of the shells before and after burning. This showed that in their natural state a hundred pounds of shells contained ninety-eight pounds of carbonate of lime, one pound of carbonate of soda, one ounce of common salt, one ounce of silica and other insoluble matters, and eleven ounces of organic matter, with a trace of phosphoric acid and a little magnesia. Neglecting the organic matter, which would in any case be burned away by calcination, M. Verneuil next mixed a pure mineral carbonate of lime, such as marble dust, with carbonate of soda and salt, in proportions imitated from those of the shell. On roasting the mixture, a substance was obtained which gave a beautiful blue phosphorescence, somewhat less bright than that produced from the shell lime. As the perfect mixture existing in natural substances is only incompletely imitated by artificial processes, it is often necessary, in reproducing such substances, to increase the quantity of the elements contained in small proportion to give them their due effect, and a new mixture was made, containing one hundred pounds of powdered carbonate of lime, made into a paste with water in which two pounds of carbonate of soda and two ounces of common salt had been dissolved. This mixture was heated to bright redness, and, on cooling, mixed with thirty pounds of sulphur and one-third of an ounce of sub-nitrate of bismuth dissolved in alcohol, and again calcined. The substance so obtained was quite as phosphorescent as the paint made from shell lime.

A SIMPLE apparatus has recently been used in France for preparing the ingredients of concrete, which might, we should suppose, be used in works on a large scale with considerable advantage. As described in a letter to *La Semaine des Constructeurs*, the apparatus, which seems to have been originally devised by a manufacturer of concrete sewer-pipes, consists of a cylinder of copper, about three feet in diameter, mounted on a hollow shaft, which is pierced with many holes. The cylinder is also pierced with holes of varying sizes, arranged in zones, and a helix of copper is set in the interior. By a simple mechanism, driven by water-power from a brook, the cylinder is made to revolve about once a minute, and at the same time water is forced under pressure into the hollow shaft. Earth from the gravel bank near which the machine is set up is then thrown by shovelfuls into the upper end of the cylinder. The interior screw drives the material forward, at the same time that it is washed by the water issuing from the hollow shaft. The holes in the upper part of the cylinder are the smallest, and the turning, shaking and washing of the earth sifts out there the finer portions, while the rest is moved along to the next zone, of larger holes, which allow the coarser gravel to escape, the small pebbles falling through the next zone, and the larger ones remaining till the last. The different sorts of material are collected in bins, and the washing water, which holds in suspension the fine sand and loam, is allowed to run off into a basin, where it is lightly stirred with paddles agitated by the same power that drives the cylinder. In this basin the fine sand is deposited, but the movement of the water prevents the subsidence of the loamy particles, which escape through an overflow into another basin, and are there allowed to settle quietly. The material shovelled from the bank is thus, by one operation, sorted into large pebbles, small ones, of two or three distinct sizes, gravel, sand, fine sand, and loam. The large pebbles, which are unsuitable for use in making the concrete pipes, are sold for road metal or similar purposes; and the fine, soft deposit of loam in the last basin is disposed of to farmers for manure. The proceeds of the sale of these two products are sufficient to pay the whole expense of handling and treating the earth, leaving the sand and gravel, clean and ready for use in making the concrete pipes, as surplus matter, costing nothing. The ingenious manufacturer has been enabled by this process to reduce the price of his pipes very materially, at the same time that the quality is improved by the thorough washing of the material and separation of the vegetable mould, and it is worth noting that, besides materials for concrete, such a treatment would, in many soils, separate good building sand from alluvial deposits which could not otherwise be used for any building purpose.

THE *Sanitary Engineer* mentions that a company has been formed in Frankfort-on-the-Main which insures against loss or damage from burst or leaky water-pipes or defective fittings. Although it is estimated that damage from these causes occurs about a hundred times as often as injury from fire, the loss is usually not very serious, and the premium rates are low, about nineteen cents, according to the account, being charged for every five hundred dollars insured. We suppose this must be the annual rate. If so, the insurance is incredibly cheap. Few city houses escape for ten years together some damage from water, and, at this rate, supposing the policy on the house to be for five hundred dollars, which would cover any possible damage in an ordinary dwelling, the amount of the premiums paid during that period, including interest, would be little over two dollars. Supposing half the premiums to be absorbed in salaries and expenses, only one dollar would be left at the end of it to pay the plasterer, paper-hanger and fresco-painter for removing the traces of the leak which would by that time have become almost inevitable. If the German Company can make a profit at such prices, it ought to establish representatives here without delay, and we could promise it an enormous business.

ANCIENT AND MODERN LIGHT-HOUSES.[1] — XV.



THE light-houses so far described were built upon solid rocks; the engineers found a stable foundation on which to erect their structures, and if the towers were properly rooted to the rock there would be no fear of their destruction from the undermining or changing of their bases.

But there are many cases where the safety of life and commerce imperatively demands the erection of these guides to mariners on shifting shoals at long distances from shore: then are the difficulties and dangers multiplied many fold, and the skill and ingenuity of the engineer severely taxed. In many localities in this and other countries dangerous outlying shoals are marked by light-ships, but wherever light-houses can replace them, even though a great outlay may be necessary, it is advisable to erect the latter, which need but a few men to attend them, and which make a much more reliable signal, as it is not uncommon for light-ships to be driven from their moorings, thus depriving mariners for a time at least of their friendly light. As examples of how such works have recently been built, I will give a description of the construction of the Rothersand (red sand) light tower in the North Sea, Holland, condensed from a paper read before the Society of Civil Engineers and Architects at Hamburg, the 21st of April, 1886, and also of a similar structure just completed in this country at a shoal called Fourteen Foot Bank, Delaware Bay.

THE ROTHERSAND LIGHT TOWER.

The construction of this tower has a history of many years. The best way to enumerate the many difficulties under which the work was carried on and finally completed is to relate how the project was originated and developed and how at first a failure and later a success was attained.

By an agreement, the bordering states of Prussia, Oldenberg and Bremen bound themselves to mutually regulate the construction and maintenance of the aids to navigation of the Weser, and to meet the necessary expenses by a tax levied upon all the vessels entering the mouth of the river. An inspection tour was to be made annually under Prussia's authority.

In June, 1878, the first inspection drew attention to the imperfect manner in which the entrance to the Weser was lighted, and a light vessel was recommended. But as it was found impossible to moor a vessel securely, it was concluded to attempt the erection of a light tower.

The three above named allies gave Bremen the authority to build it; the matter was referred by the Light-house Establishment of Bremen to its Senate, which detailed Herr Hanks to execute the work.

This gentleman entered into correspondence with the Harkoort Company of Duisburg on the Rhine, in August, 1878, and inquired if this company would undertake the erection of the tower at its own risk, and requested it to submit a proposal.

The tower was to be built on a sandy bottom twenty feet below the surface of the water, was to have a height of ninety-three feet above low water, and to be strong enough to resist heavy seas and floating ice. Herr Hanks suggested a screw pile foundation such as are used in England.

The company expressed its willingness to undertake the work, but proposed a very massive foundation to be sunk by the pneumatic process as preferable to one built of screw piles.

Considerable correspondence ensued and an inspection was made of the site. The latter is thirty-one miles from Bremerhaven, nearly in a straight line to the island of Heligoland, a little nearer the latter, distant from any harbor, and in a locality where winds from the west and northeast get up heavy seas.

In addition, it was required that the tower be built close to the fifty-foot channel, which is constantly changing; this precluded the use of any type of foundation except the one proposed by the company, and even this had to be sunk to a considerable depth. Under the circumstances it seemed impossible to erect a working platform, nor would it be prudent to attempt to transport a caisson to the site suspended between two vessels.

Herr Hanks proposed to float the caisson to the locality, to sink it there, and then to fill it with concrete. The company believed this to be a brilliant and practical method, and perfected it by proposing to sink the caisson *on* the sand by filling it with water, and *into* the sand by the pneumatic process, the necessary machinery; namely, boiler, air-pump, air-lock, etc., to be placed within the caisson.

Plans and specifications conforming to the above were submitted on the 7th of February, 1879. The requirements at that time were different from the present tower; it was contemplated to sink it only thirty-eight feet below low water, and to be filled with concrete 13.6 feet above the same level.

While the drawings were being prepared, the Company's engineer who had been engaged on the work unexpectedly resigned. Shortly afterward he and two other engineers formed a company with the intention of competing for the construction of this tower. They were rather premature, however, in their action, as eighteen months elapsed before the fund accumulated from the right dues was large enough to begin the work. On September 15th, 1880, proposals were invited and bidders were furnished with plans and specifications, which, however, were not binding in all their details. The young company mentioned above were very anxious to get the contract, believing that its successful execution would secure them a glorious future.

The Harkoort Company bid 480,500 marks (about $120,125) not including the brush mattresses and rip-rap protection against scour; their competitors bid was 450,000 marks (about $112,500) including the above protection. As after experience showed, this protection cost 110,000 marks, so according to these figures the two estimates differed by 140,500 marks ($35,125.)

The low price at which the contract was taken was the principal cause of its failure. The contractors were compelled to save in the construction of details which should have been executed in the best manner, and were forced to neglect important preparations for which they had neglected to estimate.

The construction of the floating caisson was commenced and completed during the winter of 1880–81. On the morning of May 22, 1881, when there was a dead calm, two tug-boats towed the caisson from the harbor (Kaiser's haven) in Bremerhaven, down the Weser to the site. The caisson was not under good control; rolling heavily, it parted its tow-line in the following night, and went ashore at ebb tide. Next morning at high tide it floated off again, the hawser was refastened, and on the evening of the fourth day from leaving the harbor it had reached the site, and was sunk to the bottom by the rather primitive method of removing a large wooden plug six inches in diameter, located two and one-half feet above the bottom of the caisson. This nearly caused the caisson to upset, but finally at nightfall it reached the bottom.

All this unexpected trouble worried and discouraged the men, who had hardly slept since leaving the harbor — a few of them, under charge of one of the engineers, remained on the caisson; the rest found quarters on the steamer provided for this purpose, and moored at a safe distance from the caisson.

The next morning, when all except the mate of the steamer were sound asleep, he saw through the lifting fog that the caisson was much inclined. It took considerable trouble and time to rouse the tired men and to start the fires under the boilers so as to go to the relief of the excited party on the caisson, who had been awakened at daybreak by being rolled involuntarily from their berths. "That is caused by the ebb current," said the engineer, to encourage his men. "It scours on the south-east side; when the flood sets in and scours the north-west side, everything will be all right." But when the latter came, contrary to his prediction, the caisson inclined still further, until it reached twenty-one degrees from the vertical. The engineer, as well as the men, was greatly relieved when the steamer sent life-boats to take them off; they got on board without loss of time by sliding down a rope. For four days the caisson was left to its fate, and no work could be done on it, as during flood tide the water entered from above (see following cut).

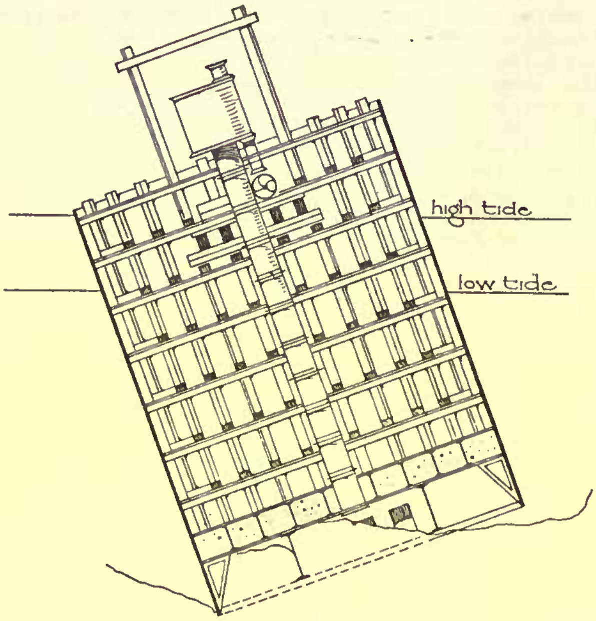
Later, by the counter action of the flood-current, the caisson took a more upright position, about ten degrees from the vertical. Its height was increased six and a half feet before the May storms commenced. When they abated on June 14th, and the working-party returned, they found that the scour caused by the storms had acted favorably; the caisson stood perfectly plumb and had sunk into the sand from seventeen to eighteen feet.

The concrete filling was now commenced and the machinery put in order. A month later the water in the air-shaft and working-chamber was displaced by compressed air, and on August 4th the sinking of the caisson began. During the next two months the weather was fine, and the caisson was sunk nearly twenty-six feet farther into the sand, bringing it seventy feet below low-water mark — a considerably greater depth than the original plan contemplated.

But while this work was going on, the height of the caisson and the amount of concrete filling was but slightly increased, and little was done to protect the caisson from the approaching October

[1] Continued from page 74, No. 607.

storms. During the May storms, when the upper edge of the caisson was twenty-two and one-half feet above low water, the seas ran so high as to entirely submerge it, yet the iron was carried only twenty-



six feet above low water, and worse than this was the delay in the construction of the brick lining and concrete filling, difficult operations, necessarily consuming much time. In the early part of October the brick lining had not been commenced, the concrete filling was only up to a level with the bottom of the sea, and the brush mattresses and rip-rap were still over thirty feet below low water. In addition, the weak wrought-iron sides were only braced with timbers not strong enough to resist the combined action of the wind and sea.

The contractors were warned of these defects and deficiencies, but did not remedy them, preferring to continue the sinking of the caisson, as, according to agreement, they could draw money by partial payments, the amounts being proportioned to the distance the cutting-edge penetrated the sand.

Of course it was impossible to leave men on this insecure structure, so when bad weather caught them on October 9th, the working-party was compelled to run for a harbor. About three or four miles from the site, and toward the shore, the light-ship "*Brimen*" was moored on the Weser. At noon, on October 13th, 1881, when the lookout accidentally sighted the structure, it seem to him to suddenly disappear. He could not believe his eyes. Grasping his telescope, he scanned the horizon closely, but could find nothing. The tide had risen to a height of sixteen and one-half feet, so that the ironwork projected only a little more than eight feet above the sea. The waves rolled heavily over the structure, breaking or knocking out the iron braces, and the whole work, with the boilers and machinery collapsed. It was reported that the caisson, after penetrating forty feet of sand, had struck a layer of semi-fluid silt, and dropped out of sight. Pictures illustrating this story were printed and circulated.

When fine weather permitted an examination of the site by divers, it was found that the iron mouth of the caisson had been broken off seven feet above the bottom of the sea, and that the boiler and machinery had fallen toward the lee side (south east) of the structure.

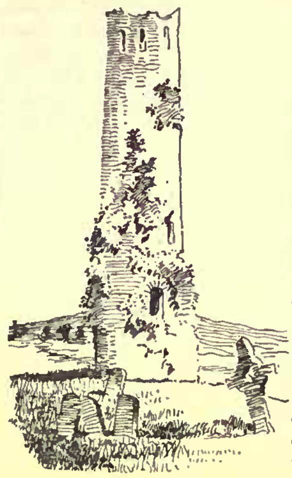
The expenditures had been $97,500 to date; of this amount the contractors lost $31,250, their own capital; those who furnished the materials and loaned money lost $46,250, and finally, the Government $20,000, for the total amount ($45,000) of all installments previously paid was only secured by a bond of $25,000.

So ended the first attempt to erect a light-house in the breakers of the "Red Sand" Shoal.

[To be continued.]

Underground Wires.—Mr. W. H. Preece, an English paper says, recently read a paper before the Society of Arts, on "Fifty Years' Progress in Telegraphy." Speaking of underground wires, he says: "In London alone we have 255 miles of pipe, containing 10,212 miles of wire. In fact, all our great trunk lines are out of danger of stoppage from storms. We have 868 miles of open wire included within the metropolitan area, but these are chiefly in the suburbs, and include long, outlying sections, used either for police or fire-brigade wires or for private persons. There are 213 offices in London now served wholly by buried wires." It appears that in 1886 there were in the United Kingdom 26,425 miles of overhead telegraph lines, embracing 150,590 miles of wire, and 677 miles of underground lines, with 19,605 miles of wire. It is estimated that to connect only the more important towns by underground wires, and "uniting those towns by less than half the existing number of overhead wires, would cost something like £2,500,000." Of submarine cable there are now 112,673 nautical miles, which has absorbed a capital of £37,000,000. The larger part of this, or 102,531 miles, is owned by 27 private companies, having from 1 to 53 cables each.

THE ROUND TOWERS OF IRELAND.—I.


Clonmacnoise.

It is not easy to understand, in these days of antiquarian discoveries, when the "hidden things of darkness" are every day being brought to light, that there should be any doubt as to the origin of anything of antiquarian interest, or any difficulty, if doubt exists, in clearing it up. When cities, great in bygone ages, have been completely lost, so utterly ruined and deserted and so absolutely buried by the ever-increasing dust of ages — the very sites of them so entirely obliterated that men begin to speculate as to whether they really ever existed at all, and to tell us that the traditions of our childhood connected with them, and the histories which have been as meat and drink to many a savant for hundreds of years are nothing but absurd fables—when these are being unearthed and such strange discoveries made about them that in a little while we become acquainted with even the manners and customs of the people who lived and thrived in them, is it not a strange thing that there should still be so little known about the origin, use and intention of the Round Towers of Ireland? Theory after theory has been advanced, but not one has taken hold of the majority of antiquarians, or is looked on by those who may be supposed to be interested in the matter as anything more than a theory. Nothing has been satisfactorily proved about their origin, and not much has been *proved* that is of real consequence.

It is said to have been proved without a doubt that they were erected in the course of certain eight centuries, but what a wide margin of speculation this leaves us still. Through what scenes, — peace, war, prosperity, poverty — may not a country pass in the course of eight hundred years. Take old England, for example, in the fifth century and compare it with its appearance in the thirteenth century and what changes do we see? A change from comparative barbarism to civilization, and what greater change could come to a country in a forward direction; but then the period is by no means a limited one. Eight hundred years is not a small portion of a country's history. Let us agree that this was the case, that these towers of Ireland were, as it is said, all erected between the fifth and thirteenth centuries of the Christian era — we shall certainly be on the safe side. We must naturally suppose, then, that there was little or no progress made in Ireland for a whole eight hundred years, that the people went on in the same unchanging round, building in almost the same manner, because the same occasion for the buildings remained, and, therefore, living in the same manner, with no enlargement of ideas, and, therefore, no intercommunication with other lands, no trade nor commerce, which must have brought change, for eight hundred years. It is hardly possible to believe this against the facts of progress that we have of other countries, and, therefore, it must be possible to confine this tower-building fashion to a lesser period, even if it be not possible to settle upon one or two centuries.

The greatest and most convincing evidence that can be produced for the establishment of a theory of progression is undoubtedly the solid witness borne by stones and mortar in which we can trace characteristic details that will leave little room for doubt as to their origin. And here is the great difficulty with regard to this question of Irish round-towers, that between Western Asia and Ireland we can find no towers answering to the description of those we wish, and have reason to expect, to find. Unlike the history of Classic and Gothic architecture, which we are able to trace step by step and mile by mile from Egypt to England, we are here confronted with a break in history as written in the stones of the buildings themselves, we have to come to the end of a string of evidence which has filled us with hope that we might trace, however faint the lines, the existence of some kind of chain of evidence connecting the East with the extreme west of the old world, and search as we will through ancient examples, through Asia Minor and Southern Europe, we cannot discover one tower of the same form.

That there was some early connection between Ireland and the East suggests itself as possible, and it is only after searching high and low that I venture to think I have found some clue. We are so accustomed to trace the well-known forms from land to land, from building to building, and the history of the people among whom we find them is so well known that we hardly stop to investigate the exact circumstances which lead to the reproduction in one country of forms we last saw in another farther east. We know that this and that warlike expedition carried hundreds of men from one place to another, and that in the footprints of armies merchants established their means of traffic and in time of peace these footprints became highroads of commerce. Not only so, but lands yet more distant, and separated by a vast expanse of water, were gradually connected and brought within the reach of trade. Trade bridged these seas, and, whether by land or by sea, customs, fashions, and ideas were disseminated from the older all over the newer countries. Thus far we are able to trace successive steps.

Mr. George Petrie has investigated these towers very carefully, and, in his interesting book on "*The Ecclesiastical Architecture of Ireland,*" proves beyond possibility of doubt to himself that they were erected by Christians and for religious purposes. Mr. Fergusson says, and truly, that there is any amount of room for speculation with regard to these towers, not only as to their age, but also as to their use, were it not that Mr. Petrie has already said so definitely that they were for religious purposes. As to their origin, Mr. Fergusson says: "No one supposes that this kind of tower was invented by the rude builders of the early churches, and no theory yet proposed accounts for the perseverance of the Irish in its employment, while the practice of all other nations of Europe was so widely different." Mr. Fergusson, when he writes this, is fully believing in what Mr. Petrie had said, that they were built between the fifth and thirteenth centuries. But I doubt very much if Mr. Petrie meant that the first was built in the fifth and the last in the thirteenth. He takes a long period and says, in effect, somewhere during this eight hundred years these towers were built. Therefore, it does not at all follow that the Irish did so persevere in the practice of round-tower building for so long a period of time, which would, indeed, be contrary to the ways of other nations, not only European, but of all countries in the known world.

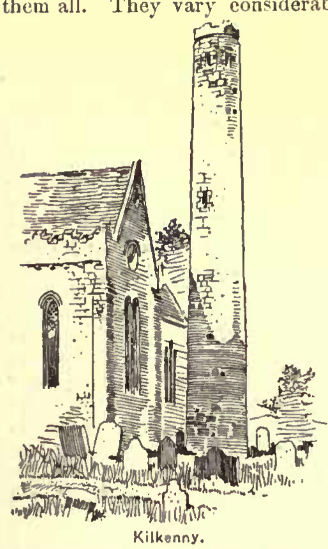
Mr. Fergusson goes on to say that they are undoubtedly of Christian origin, as may be gathered from their details, and, describing some of these, he limits the dates of their construction to within two or three hundred years. Here, at least, is something more satisfactory and definite, but this he propounds with doubt. In these towers taken altogether, we may find all kinds of details and all qualities of workmanship, and one is struck by the great difference existing between the characters of towers within a short distance one of another, those apparently of greater age being at greater distances apart, the later ones, as it were, filling up intermediate spaces. From this we may gather that they were originally few and far between, that they were erected just where they were considered necessary, whatever their purpose may have been, and that, as the population increased and new places sprang into existence, so the need, or possibly only the desire, for the towers increased, and others were erected to meet the demand, the details of the later ones differing only slightly from the original ones, and the difference being more in the matter of ornamentation than in construction or general design.

The characteristic of all these towers is the extreme simplicity, and viewed from a short distance, they may all be said to be alike. The principal and most conspicuous difference between them is that of height. The highest is believed to be that at Old Kilcullen, which



St. Bridget's Cathedral end Round Tower, Kildare.

is 130′ high. That at Kildare is 108′ high, 54′ circumference at the top, and this one will serve as an example of the proportions of them all. They vary considerably in height. At Devenish is one only 82′ high, at Kilkenny the tower is 100′ high and 46′ 6″ in circumference at base. To describe the whole, or anything like the whole of over one hundred and twenty of these towers which exist would be a long task and would become uninteresting. Those I have already mentioned and a few others I shall refer to, being sufficient for the purpose.



Kilkenny.

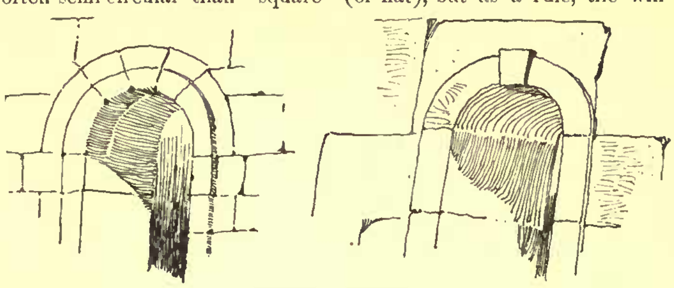
These towers, then, presenting in appearance great hollow pillars, are always circular on plan. They are usually built with rough stones, some very large, others very small, put together in the most haphazard manner just as they come to hand, and with thick joints filled up with cement. As an exception to the rule, the tower at Ardmore is built in regular courses of beautiful ashlarwork, but this tower is an isolated peculiarity, quite different from all the others, and is among the most modern. As a rule, the walls rise without any projecting string or ornament from base to summit, diminishing in diameter as they ascend, and are capped with a conical roof of stone, resting on a slightly projecting cornice. They are hollow from top to bottom, though it is by no means improbable, but rather, highly possible, that they had floors and that these, being of wood, have decayed or been destroyed, and, no doubt, used for firewood. Many of them have been recently fitted up with new floors and ladders for the benefit of the traveller, who seldom fails to put himself to the trouble and exertion of mounting them to see what he can from the top, even if he has no further interest in them, and there is always some one, often the village clerk or sexton, in waiting to benefit also materially from the presence of the stairs and the visitor.

Of external openings there are but few; the door is usually some feet from the ground, and there are no more windows than absolutely

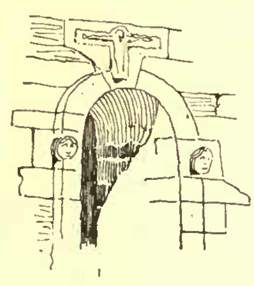


Devenish.

necessary for lighting the interior, except in the top story just below the eaves, where there are generally three, four or five windows of equal size and shape, and all at the same level. Windows in the earlier towers are very rudely formed; generally the opening is covered with either a single flat stone or with two stones set on end and meeting so as to form a triangle with the imaginary line drawn across the imposts. Later they were executed with greater care; round heads were attempted, but even these were for a time of the rudest description — two stones placed on the imposts so as to butt together over the centre of the opening, with the under side roughly scooped out so as to form a semi-circle. Door-heads were more often semi-circular than "square" (or flat), but as a rule, the win-

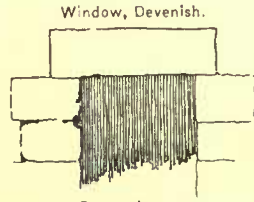


Doorway, Devenish.

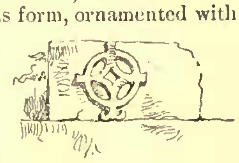


Window, Devenish.

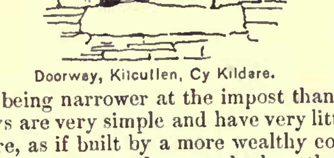
dows are either flat or triangular headed. At Donoghmore, County Meath, is a doorway with an arched head, correctly formed with radiating joints, and this especially deserves notice on account of an attempt at decoration. The imposts are emphasized by the introduction of two rudely-cut heads slightly projecting from the face of the wall. The arch is formed, as I have said, with radiating joints, and the extrados follows the line of the intrados; there is a true keystone of curious form, ornamented with a raised crucifix rudely carved. At Antrim is a doorway the head of which is formed of one large stone lintel, on the top of which lies another large stone, on which is neatly cut a small cross with circle round it. The doorway at Monasterboice is of earlier form, of one stone with the underside hollowed out into the form of a semi-circle, but the joints and architraves are ornamented with a continuous raised but simple "fascia." The sloping jambs of most of the doorways are a feature of interest and worthy of special note, the open-



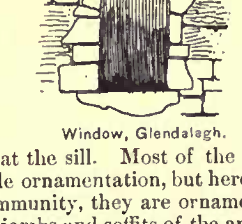
Donoughmore.



Antrim.



Doorway, Kilcullen, Cy Kildare.



Window, Glendalagh.

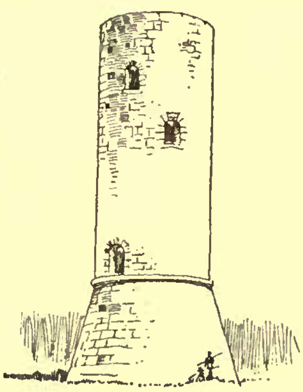
ing being narrower at the impost than at the sill. Most of the doorways are very simple and have very little ornamentation, but here and there, as if built by a more wealthy community, they are ornamented with mouldings and tracery both on the jambs and soffits of the arches, but all these embellishments are kept *within* the opening, and whenever there is any ornament on the face of the wall, it is executed in very low relief and is of an insignificant character.

As to the windows, these are, as I have said, few and far between in the height of the tower. The majority are flatheaded, and there is no attempt at ornamentation. The conical cap, or roof, sometimes gives place to a battlemented top; when the cap is used, the eaves are made to project considerably beyond the wall. The cone is carried up to its apex in stone to a height averaging ten feet above the eaves. For picturesque effect, the cone is far above the battlements, and there can be little doubt that the latter were an inovation; with the one the tower is complete and looks so, but with the other, the finish is decidedly satisfactory.

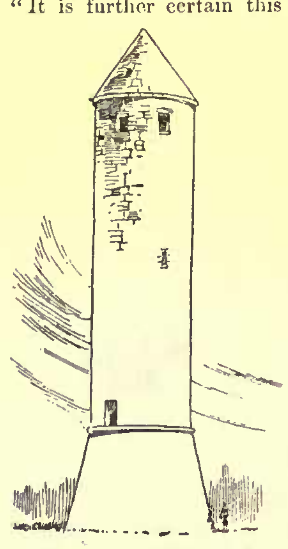
Here is an extract from Mr. George Petrie's "*Ecclesiastical Architecture of Ireland*," after which we will leave that country for awhile and take a look round the world and notice other buildings which have, I believe, a decided bearing upon the origin of the round-towers. Mr. Petrie writes with the force of conviction, and puts forth his "Summary of Facts" in a very decided tone. Having described the towers and argued his points, he winds up the matter with the following notes:

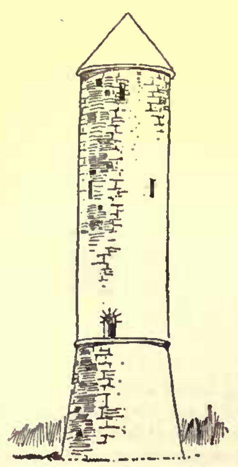
"That not even the shadow of an historical authority has been adduced to show that the Irish were acquainted with the art of constructing an arch, or with the use of lime cement, anterior to the introduction of Christianity into the country, and further, that though we have innumerable remains of buildings of ages antecedent to that period, in no one of them has an arch, or lime cement been found. That in no one building assigned to pagan times, either by historical evidence or popular tradition, has been found either the form or features usual in the round towers, or characteristics that would indicate the possession of sufficient architectural skill in their builders to construct such edifices. That towers are *never* found *unconnected* with the ancient ecclesiastical foundations. That previous to General Vallancy, a writer remarkable for the daring rashness of his theories, for his looseness in the use of authorities, and for his want of acquaintance with Mediæval antiquities — no writer had ever attributed to the Round Towers any other than Christian, or at least Mediæval origin. That their architectural styles exhibit no features or peculiarities not equally found in the original churches, with which they are locally connected when such remain. That on several of them Christian emblems are observable, and that others display in their details a style of architecture universally acknowledged to belong to Christian times.

"That they possess invariably architectural features not found in any buildings in Ireland ascertained to be of pagan times." After giving a description of some of the towers Mr. Petrie goes on to say, "The preceding description will, I trust, be sufficient to satisfy the reader that the Round Towers were not ill adapted to the double purpose of belfries and castles, for which I have to prove they were chiefly designed, and keeping this double purpose in view, it will, I think, satisfactorily account for these peculiarities in their structure, which would be unnecessary, if they had been constructed for either purpose alone. For example, if they had been erected to serve the purpose of belfries alone, there would be no necessity for making their doorways so small, or placing them at so great a distance from the ground; while on the other hand, if they had been intended solely for ecclesiastical castles, they need not have been of such slender proportions or great altitude.


Brunless.

"It is further certain this use (that of belfry) is assigned to


Clondalkin.


Roscatberry.

them, by the uniform tradition of the whole people of Ireland, and that they are appointed to this use in many parts of the country even to this day.

"The most ancient military towers subsequent to Roman times, found in the British Isles, and which are built with stone or lime cement, are invariably of this round and lofty character, having their doorways small and considerably elevated from the ground, and their floors composed of wood.

"As a remarkable instance of the agreement of the British castles with the Irish Round Towers, I annex an outline of the castle of Brunless in its present state. If we restore the outline of this castle to its probable original height, it will be found to be almost identical, in most of its features, with several of our Irish towers, as shown in the annexed outlines of the existing towers of Clondalkin and Roscatberry.

"Abundant evidence exists to prove that the doorways were originally furnished with double doors."

I have given these somewhat lengthy extracts in order that those who have not studied the subject may have some idea of the theories existing about the Round Towers, as well as that they may know the points that are argued, but as we go on with the investigation I think we may see cause to differ.

[To be continued.]

THE ILLUSTRATIONS

[*Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.*]

VIEW IN JAPAN.

[Gelatine Print, issued only with the Imperial and Gelatine Editions.]

ORANGE CLUB-HOUSE, BRICK CHURCH, N. J. MESSRS. LAMB & RICH, ARCHITECTS, NEW YORK, N. Y.

THIS was the design selected, after competition, for the Orange Club. The building contains an immense two-story hall, ladies' reception-room, library, card-room, café, billiard and pool rooms, two dining-rooms, committee-room, perfectly-appointed toilet-rooms for tennis club, besides about twenty sleeping-rooms, etc.

AN ETCHING BY BRUNET-DEBAINES.

HARFLEUR, once the most thriving seaport of Normandy, has long since given way to Havre, and is now a small town of less than 2,000 inhabitants. The harbor has been filled up by the deposits of the river Lézarde, which here falls into the Seine.

The fine Gothic church of St. Martin, which forms the conspicuous object of the etching, was founded, according to local tradition, by Henry V of England, whose siege of the town is so vividly recorded in Shakespeare. This attribution is, however, probably wrong, as the edifice shows a somewhat later style than that of the period of the besiegement.

Casimir Delavigne said of it:

> "*C'est le clocher d'Harfleur, debout pour nous apprendre*
> *Quel Anglais l'a bâti, mais n'a su le defendre.*"

which couplet we render (somewhat freely)

> "'Tis the steeple of Harfleur, which we apprehend
> The English have built, but could not defend."

The church was restored in the sixteenth century. Its interior contains some interesting monuments. A view of the doorway was published in the *American Architect* of September 10, 1887.

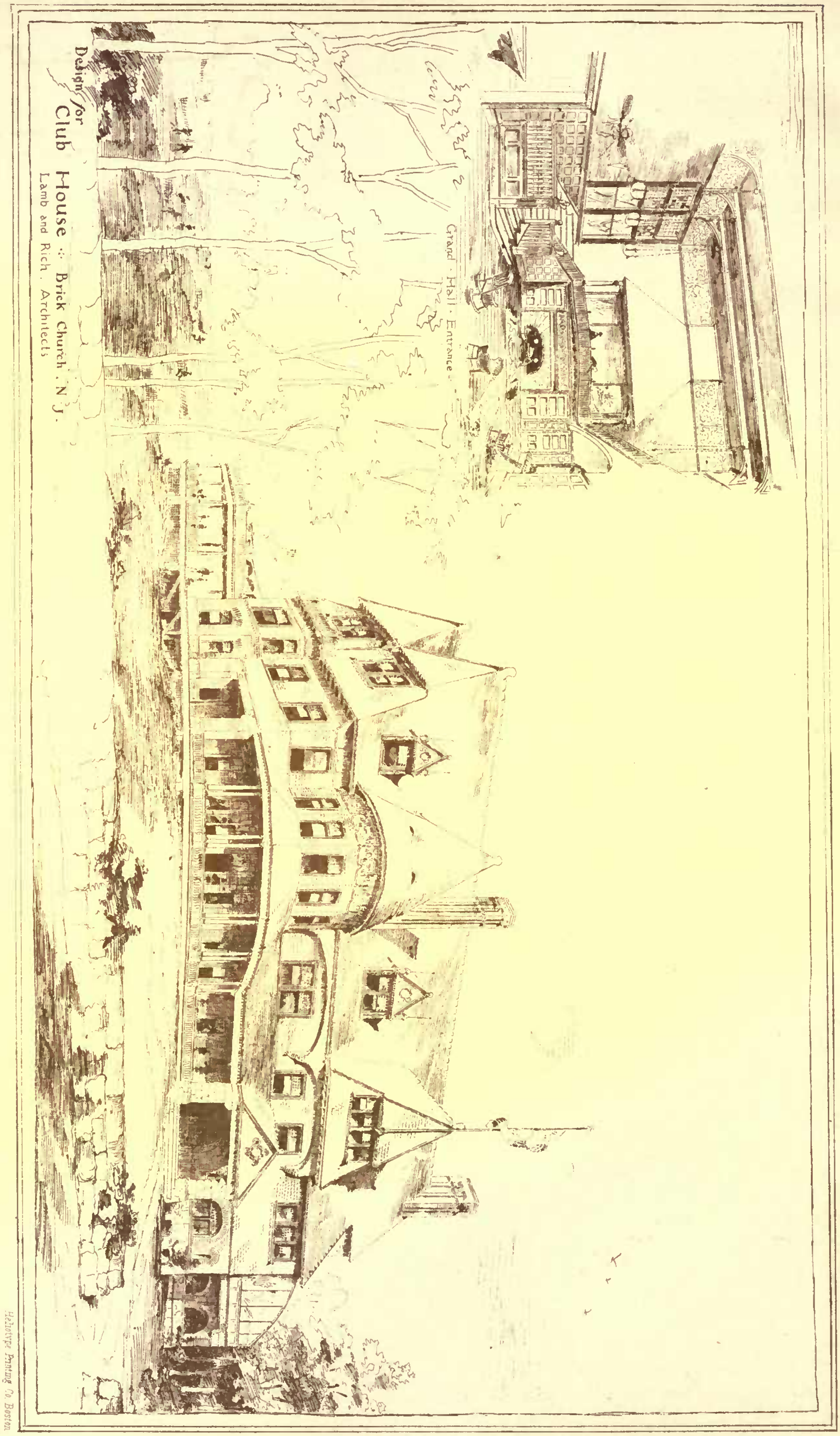
The château of Harfleur, a pleasing structure of brick and stone dating from the seventeenth century, was restored by Viollet-le-Duc.

Alfred Brunet-Debaines is a Norman, a native of Havre and a pupil of those distinguished etchers, Gaucherel and Lalanne. He is "*Hors Concours*," having gained two medals at the *Salon*, and one of the most accomplished living masters of the needle, both in original and reproductive etching. Among his original plates are the "Hôtel-Dieu, Paris," "The Château of St. Germain-en-Laye" and "The Interior of the Church of St. Omer, at Pont-Audemer." Besides making various translations of the old masters — notably, Rembrandt's "Mill." M. Brunet-Debaines has etched after Decamps, Daubigny, Corot, Dupré, Français, and other French painters, and executed some important works from English artists, such as Turner's "Burial of Wilkie," Constable's "Valley Farm," David Cox's "Vale of Clwyd," Linnell's "Last Gleam before the Storm," and Millais's "Chill October." One of his finest etchings is the "Church of Santa Maria della Salute, Venice," after the well-known Canaletto in the Louvre, and one of his latest and largest is "Windsor," after Herr Carl Heffner.

The original etching was kindly loaned to us by Messrs. F. Keppel & Co., of New York.

THE "MALTBY" APARTMENT-HOUSE, WASHINGTON, D. C. MR. ROBERT STEAD, ARCHITECT, WASHINGTON, D. C.

THIS building will be erected on New Jersey Avenue, facing the United States Capitol, and will be built of brick laid in red mortar, with Potomac red sandstone trimmings, copper gutters, finals, etc. The owner is Maltby G. Lane of New York.


Design for
Club House :: Brick Church . N. J.
Lamb and Rich. Architects
Grand · Hall · Entrance ·



Heliotype Printing Co. Boston.

Dormer, Chateau de Blois



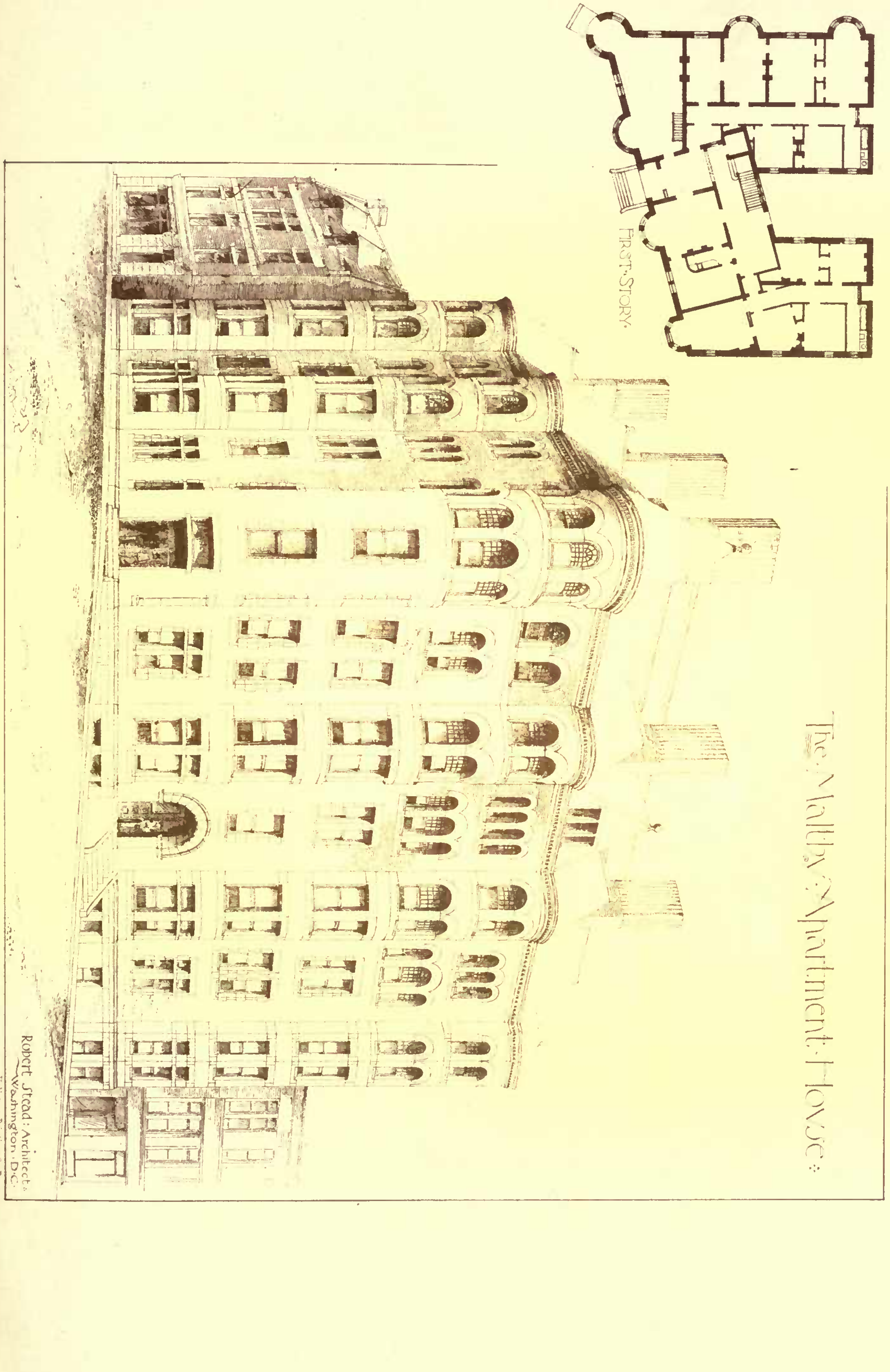
House for Mrs. C. T. Sisson: Hyde Park: Ill.

@ H. L. Elliot: Architect Chicago.

Heliotype Printing Co. Boston.




A. Brunet-Debaines. Sc.


First Story.
The Maltby Apartment House.
Robert Stead: Architect. Washington. D.C.
Heliotype Printing Co. Boston

HOUSE FOR MRS. C. T. SISSON, HYDE PARK, ILL. MR. J. H. ELLIOT, ARCHITECT, CHICAGO, ILL.

THIS house, now building, will cost about $5,000.

A DORMER. CHATEAU DE BLOIS, FRANCE.

BUILDING MATERIALS.[1]—V.



OF all natural productions, there is not one that is of greater importance to the builder, or that is applicable to so many manufacturing purposes, as limestone, this being the general term by which all rocks may be designated which have carbonate of lime for their basis. These calcareous deposits belong to several geological formations, and differ materially from each other both as regards their chemical composition and their physical character, being sometimes in the form of a dense hard rock, as is the case in what is known as carboniferous or mountain limestone, many of the beds of which are of great thickness, consisting of nearly pure carbonate of lime. In the limestones of the Lias, on the contrary, the carbonate of lime is associated with silica and alumina in proportions varying from ten to twenty per cent, of which we have examples in the limestone of Aberthaw, in Glamorganshire, the Barrow limestone in Leicestershire, and the limestone of Warwickshire. These Lias deposits consist of comparatively thin layers of hard limestone separated by others of a more argillaceous character, or shales, containing various proportions of carbonate of lime. The Lias district extends from Lyme Regis, in Dorsetshire, to the northeast of Yorkshire, the limestone being worked chiefly in the counties of Dorset, Warwick and Leicester, yielding, when calcined, the best description of hydraulic lime. In the chalk districts of Kent and Surry, we have in the upper white chalk a soft description of comparatively pure carbonate of lime, and in the gray chalk which lies immediately below it we have a carbonate of lime of a somewhat harder description, associated with a small proportion of argillaceous matter.

One of the most wonderful and curious formations of limestone is that which results from the agency of the coral polype, which possesses a power of abstracting carbonate of lime from the water of the ocean, and is thus enabled in warm climates to construct those enormous reefs which, in some cases, extend for hundred of miles in the Pacific and Indian seas. The coral, as produced, is carbonate of lime, soft and porous at first, but it gradually becomes hard and compact, so much so that it is capable of being used as a building stone, as is the case in some of the South Sea Islands. In the course of its formation, all kinds of marine *débris* get mingled with it, which, when cemented together, produces a rock that bears a resemblance to some descriptions of the older limestones. The sediment resulting from the trituration of the coral when deposited in sheltered water channels, produces a material similar in appearance to chalk, whilst the coral from reefs that have been upheaved by volcanic agency, is found to be of a sparry or crystalline character. These coral reefs occur in every stage of development, from the coral that is daily growing to that of a compact solid mass resembling some of the softer marbles, and thus, owing to the changes that take place from the action of the waves, and to the elevation or depression of the ocean bed, a coral reef eventually becomes a more or less compact limestone, so that as the result of the labors of the coral polype, we have deposits which represent several varieties of limestone.

Carbonate of lime is found in a state of chemical purity in rhombohedral crystals, as Iceland spar, which (as is well known) possesses the property of refracting light in a peculiar and remarkable manner, and has hence received the name of double refracting spar. Carbonate of lime is also found in six-sided prisms, known to mineralogists as aragonite, so called from Aragon, where it occurs in large macled crystals, in the gypsum deposits in that part of Spain. The form of crystal assumed by carbonate of lime depends upon the circumstances under which the crystalization takes place, such as temperature (the tendency to the formation of aragonite being greatest when it crystalizes from warm solutions), the degree of concentration of the solution, and the presence of foreign substances. Its purest form as a rock is that of white marble, the colored marbles containing iron, manganese, and carbonaceous matter. The proportion which the carbonic acid bears to the lime is as twenty-two to twenty-eight, lime itself being an oxide of calcium. Calcium is a light malleable metal, somewhat harder than lead, tarnishing rapidly on exposure to the air by the absorption of oxygen; when heated to redness it burns with a brilliant, scintillating white light. It has not received any practical application in the arts, and is only capable of being produced in very small quantities for experimental purposes.

By exposure to a red heat, under ordinary circumstances, carbonate of lime is decomposed, the carbonic acid is driven off, and the lime remains in an uncombined or caustic state. The time required for completing this decomposition depends upon the character of the limestone, and the circumstances under which the "burning" (as it is termed) of the limestone is conducted.

If carbonate of lime be heated in a confined space, such as a close retort, where there is no possibility of the escape of carbonic acid, complete decomposition cannot take place, however high the temperature may be raised; the limestone becomes surrounded with an atmosphere of carbonic acid, and until this is removed its further decomposition is arrested. Chalk under such circumstances may assume a highly crystalline condition, and thus in nature we find dull granular limestones that have been altered in their character by the intrusion of an igneous rock; we have an example of such conversion in Rathlin Island, off the north coast of Ireland, where two basalt dykes ascend through the chalk, converting the latter into a fine granular marble. Experiments were made many years ago which proved that when the carbonic acid liberated was rapidly carried off by a current of steam or air, the rapidity with which the limestone was decomposed was increased, a fact which it may be well to remember in discussing the merits of different modes of calcining. The process of "lime burning" is carried out in several different ways, in comparing the advantages of which it is necessary that the various circumstances that bear upon the question, such as the character of the stone and the amount of lime that can be disposed of in a given time should be considered.

Whether the operation be carried out in the simplest manner, or in the kilns constructed on the most scientific principles, much will still depend (both as regards the quality and quantity of the lime produced) upon the kilnsman, for it is only by constant observation from day to day that the eye becomes capable of judging whether the proper temperature has been reached, or that a correct opinion can be formed as to the effects produced by the various disturbing causes which exert an important influence upon the working of a kiln, such as its size, shape, the character of the limestone, the quality of the fuel, and the state of the atmosphere.

The kilns usually employed vary as regards size and shape in different districts, consisting generally of inverted cones or ellipsoids, into which layers of limestone and fuel are alternately thrown. When worked continuously as running kilns, the lime is periodically withdrawn from below, fresh quantities of stone and fuel being filled in at the top. It is obvious that the consumption of fuel must be much less when worked continuously than is the case when, after every charge, the kiln is allowed to cool down before the lime is removed. It is very difficult (even when every care is taken) to obtain from ordinary kilns, when worked continuously, a uniformly satisfactory product; the temperature is not sufficiently under control, and sometimes increases more rapidly in one part of the kiln than it does in another; or not unfrequently a block occurs, and a mass of stone and fuel remains immovable for a considerable time, and when this stoppage is overcome the mass gives way, and a quantity of lime and half-calcined limestone comes down together. Owing to these uncertainties, which no precautions can entirely guard against, when it is essential that the limestone should be equally and thoroughly calcined, the kilns are worked on the intermittent system, the charge being put in at once, and the kiln allowed to cool down before the lime is removed, the extra cost of fuel being more than compensated for by the superior quality of the lime obtained.

In the chalk districts, in which what is termed "flare lime" is produced, to distinguish it from the lime as obtained from the kilns to which I have referred, the process is carried out in a somewhat different manner. Only a small quantity of fuel is mixed with the chalk, its calcination being chiefly effected by the flames of the burning coal placed below. A fire-place is constructed in the outer wall of the kiln of brick arches, these arches being continued within the kiln by piling up large blocks of chalk, over which the remainder of the chalk is filled in; the fire below the arches is lighted, and when the whole mass has attained the requisite temperature (which is determined by the experienced eye of the kilnsman), the fire is allowed to burn out, and the lime, when cold, is withdrawn. These kilns will turn out about thirty tons of lime with a consumption of about nine tons of coal. A variety of kilns have from time to time been proposed with the view of diminishing the consumption of coal, few of which have been constructed on sounder principles, or have been more successful in attaining the desired object, than those of Hoffmann, which are frequently alluded to under the name of circular or ring kilns.

The great economy as regards fuel, effected by the use of kilns of this description, is obtained by causing all the air entering the kiln to pass over the lime that has already been calcined before it reaches the burning fuel, and the products of combustion, together with the

[1] A lecture by W. Y. Dent, F.C.S., F.I.C., read before the Society of Arts, and published in the *Journal* of the Society. Continued from page 135, No. 612.

carbonic acid and vapor of water from the limestone, to pass over the fresh limestone before reaching the chimney. By the arrangement adopted, the air is raised to a high temperature before it reaches the fuel by taking up the waste heat from the hot lime, which in ordinary kilns is entirely lost. Combustion takes place under the most favorable conditions, the fuel being consumed in the most perfect manner, with scarcely any escape of smoke. The heat recovered from the gases evolved is sufficient to raise a portion of the limestone almost to dull redness before it meets with the burning fuel, and the amount of heat that escapes is little more than what is required to create a sufficient draught in the chimney.

The kiln consists of a flat-roofed circular or elliptical tunnel, divided into twelve or more chambers, placed round a central chimney-shaft; the flues which connect each chamber with the central chimney are so arranged as to be capable of being closed at pleasure. Two adjoining chambers of this series are opened (generally every day), in one of which the operation of charging with fresh limestone is going on, whilst the lime is being taken from the other. The air entering at these open chambers passes through four chambers filled with hot lime, which it cools down, becoming more and more heated before it reaches the two or three chambers in which the fuel is being consumed, and afterwards passes through the remaining chambers of the series filled with fresh limestone, finally reaching the chimney through the flue of the last chamber that had been filled on the previous day.

The fuel used is small coal, which is thrown in at the top of the flat roof of the kiln in very small quantities at a time through openings communicating with shafts that are left to receive it when stacking the limestone. These openings are closed by loose covers that are only lifted at the moment when the coal is put in, or for the purpose of observing how the kiln is working.

The kilns are constructed on a very large scale, each of the chambers in a kiln which has now been worked for twenty years in North Wales being capable of turning out twenty tons of lime. The building of such kilns involves a large outlay of capital, and it is necessary that they should be kept going constantly and regularly, as the kiln after having been once lighted is never allowed to go out, every chamber taking its turn for the operations of filling, firing and discharging. It is evident under these circumstances that kilns of this description are most suitable for large works and where there is a constant demand for the lime produced.

Another description of kiln has recently been brought out for burning lime and cement, known as the Dietzsch kiln, which is still more economical as regards the consumption of fuel than Hoffmann's, inasmuch as there is less waste of heat, owing to the portion of the kiln in which calcination takes place never being allowed to cool except for repairs. This kiln consists of a vertical shaft, divided horizontally into two parts, which are connected together by a short horizontal chamber. The upper part of the shaft is kept charged with the raw material, which gradually falls by its own weight into the horizontal chamber, from which it is passed on as required, by means of shovels, to that part of the lower portion of the shaft in which its calcination is completed, and which is maintained at a high temperature by the continual addition of fuel (in small quantities at a time), through apertures made for this purpose and for stoking. The calcined material is allowed to fall into a cooling chamber, through which air is supplied to the kiln. By this arrangement the cement or lime does not remain in contact with the fuel for a longer time than is necessary for its calcination, and no heat it wasted in having to warm up the walls of the kiln after every discharge. The air supplied to the kiln is warmed by passing over the calcined mass, which it cools, whilst the gases produced by the combustion of the fuel give up the greater portion of their heat to the freshly-charged material before escaping from the top of the shaft. It is stated that in a kiln of this description a ton of cement does not require more than from two to three hundredweight of small coal for its calcination. The Dietzsch kiln has only quite recently been introduced into this country. Its construction is simple, but it requires more constant attention than ordinary kilns.

It has been proposed to use gas as the fuel for lime-burning, a plan which has the advantage of not bringing the lime into contact with coal or coke, and consequently produces a lime of better color. Although attempts have been made to adopt this process on a considerable scale, I am not aware of their having been brought to a successful issue in this country, owing to the difficulty that has been experienced in so regulating the supply of gas and air as to insure the ignition of the mixed gases taking place in such a manner as to produce a uniform temperature throughout the mass of limestone, and in making the kiln gas-tight. It may be anticipated that, with more experience, these difficulties will disappear, but at present the Hoffmann kiln for lime-burning is entitled, by long experience of its merits, to be considered as one of the best, both as regards efficiency and economy.

When lime has not been properly calcined and will not slake with water, it is termed "dead burnt," which may arise from two causes: from insufficient burning, when the limestone, instead of being entirely caustified, has only been changed into a basic carbonate consisting of two equivalents of lime and one of carbonic acid, one-half only of its carbonic acid having been expelled; this basic carbonate, on the addition of water, instead of forming a hydrate of lime and being converted into a fine impalpable powder, attended with the production of a large amount of heat, is changed with but comparatively little elevation of temperature into a mixture of hydrate and carbonate.

In the case of hydraulic limes which contain a considerable amount of silica, this "dead burning" may arise from the limestone having been subjected to too high a temperature, whereby a partial fusion of the silicate of lime formed has been produced, giving an impervious coating to the inner portions of the stone, which retards the further evolution of carbonic acid. On this account the eminently hydraulic limes require to be carefully calcined at as low a temperature as practicable, and hence, we not unfrequently find that lias lime has been imperfectly calcined. Pure limes, if subjected to too high a temperature, exhibit somewhat less tendency to combine with water than is the case with lime that has been properly calcined.

Caustic lime unites with water with great energy, so much so as to evolve a very considerable amount of heat. When water is poured upon a piece of well-burnt pure lime, heat is rapidly generated, and the lime breaks up with a hissing, crackling noise, the whole mass being converted in a short time into a soft, impalpable powder known as "slaked lime;" chemically speaking, it is a hydrate of lime, that is, lime chemically combined with a definite amount of water. In the process that is termed slaking, one equivalent or combining proportion of lime unites with one equivalent of water, or in actual weight, twenty-eight pounds of lime combine with nine pounds of water (being nearly in the proportion of three to one) to form thirty-seven pounds of solid hydrate of lime; the water loses its liquid condition, and it is to this solidification of water that the heat developed during the process of slaking is partly due. In the conversion of a solid body into a liquid, as is the case in melting ice, a certain amount of sensible heat is rendered latent, and in reassuming the solid condition this amount of heat is again rendered sensible. In slaking lime, however, a much larger amount of heat is developed than is derived from the solidification of water, which further development of heat is to be ascribed to the chemical action which takes place between the water and the lime, for chemical combination, in by far the greater number of cases, is attended with evolution of heat. The heat thus generated may be perceptible to the senses or not, according to the circumstances — thus, for instance, when carbonate of lime is decomposed by the addition of an acid, the heat developed may not be observed, because a large proportion is absorbed in the conversion of the carbonic acid from the solid form in which it existed as carbonate of lime into a gaseous state.

The heat generated by slaking lime has been made use of as a perfectly safe means of obtaining coal in fiery mines without the necessity for using gunpowder or any other explosive. A hole is bored in the seam of coal about three feet in length, and two and a half inches in diameter, into which is inserted a perforated iron tube of about half an inch in diameter, covered with a strip of canvas in order to prevent the perforations being closed by particles of lime. The hole is then nearly filled by putting in a number of short cylinders of highly-compressed lime, in which a groove is left to receive the iron tube, the charge being completed by six inches of well-rammed clay tamping; water is now forced down the iron tube, and in a few seconds the lime begins to swell, producing a quantity of steam under considerable pressure, which tends to crack the surrounding mass of coal. The temperature never exceeds 800° Fahr., so that in the most fiery mines there is never sufficient heat generated to give rise to an explosion.

The manner in which the process of slaking lime is conducted is a matter of considerable importance, because if this operation is imperfectly carried out, the plaster made from such lime will be liable to blister, owing to the subsequent slaking of small particles of lime still remaining in a caustic state, and these blisters will not unfrequently make their appearance after the lapse of a considerable time. All "rich" or "fat" limes (as those limes are termed which are obtained from pure limestones) may be slaked by mixing with a sufficient quantity of water to reduce the whole to a thick pulp, and are not in any way injured by remaining in this condition for a considerable period. In the preparation of plaster for fresco-painting, it is customary to employ lime that has been kept for a long time in the state of thick paste, so as to secure the hydration of every particle, for it is well known that the smallest portion of unslaked lime would be fatal to the plaster as a suitable material for the ground of any decorative work of art.

With the eminently hydraulic limes, on the contrary, it is necessary to adopt a different mode of proceeding, inasmuch as it is requisite that care should be taken in slaking limes of this description that too large a quantity of water should not be employed.

The energy with which hydraulic limes combine with water is not nearly so great as is the case with pure limes, and if too much water be added, and the lime is flooded, the slight amount of heat generated is absorbed. If limes of this description be allowed to remain for any length of time in a pasty condition, hydrated silicates of lime and alumina begin to be formed, and if these silicates be disturbed and broken up, the power of the lime to set subsequently is diminished. In slaking hydraulic limes, no more water should be used than is necessary to secure hydration. The slaking of such lime is carried out in practice by sprinkling water over a heap of lime, and covering it over with the sand that is intended to be mixed with it when converting it into mortar, the covering of sand serving to retain the heat that is developed, so as to enable the process of slaking to be carried out slowly throughout the mass.

By exposure to air caustic lime is slowly converted, without much

elevation of temperature, into a coarse powder, consisting of a hydrate and carbonate of lime.

Mortar consists of a mixture of slaked lime and sand, in the condition of a thick paste, which is spread in thin layers between bricks or stone for the purpose of cementing them together; the effect of the sand is to increase the points of attachment, and to render the mortar open in its texture, hence it is that the more irregular and angular are the particles of sand the better is it adapted for the purposes of mortar-making. In mortar required for plastering it is necessary that the sand used should be free from salt, and that no brackish water should be employed, on account of its containing deliquescent salts, which have a great tendency to absorb moisture, and consequently to render the plaster always liable to become damp.

The hardening of mortar is due to several causes which act collectively. In mortar made from pure or rich limes the first setting is due simply to the evaporation of the water, and to the production of minute crystals of hydrate of lime; this hydrate then slowly absorbs carbonic acid from the air, the rapidity of this absorption necessarily decreasing in proportion to the difficulties presented to the free access of air. This being the case, it is manifest that pure limes are not suitable for mortar to be used for thick massive walls, or in places where it is likely to be exposed to the action of water. It is a well-established fact that, in very heavy masonry, mortar made from pure lime may remain for an almost indefinite period in its original soft condition. In the case of mortar made from hydraulic limes, it is necessary that the mixing of the mortar should be completed as rapidly as is compatible with the thorough incorporation of the materials, and that it should be used as soon as practicable after having been mixed, for if mortar of this description be put aside for any length of time, its setting properties are deteriorated.

The pure limes are undoubtedly the most effective when lime is required for disinfecting or sanitary purposes, as, weight for weight, they contain more lime than the hydraulic limes, but for the use of the builder there can be no question but that those which partake more or less of the character of hydraulic lime are most suitable; the mortar of such lime sets quicker and much harder than is the case with mortar made from the purer descriptions of lime. It is on this account that the gray Dorking lime made from the lower chalk is preferred for building purposes to that made from the upper chalk. Mortar for hydraulic purposes may also be made by mixing with the pure limes calcareous clays or shales, which have been so altered by the agency of heat that the silica they contain has to some extent assumed the condition of soluble silica. The mortar which was held in such high estimation by the Romans consisted of lime mixed with puzzuolana, so named from a small town at the foot of Mount Vesuvius, in the neighborhood of which it was first obtained. It is also found in other localities which have been subjected to volcanic eruptions. This puzzuolana is an altered felspathic tufa, the silica of which has been so changed in its character as to be in a more or less soluble condition.

Trass is a material similar in its character to puzzuolana, obtained from the pits of extinct volcanoes in the valleys of the Rhine, between Mayence and Cologne, as well as in various parts of Holland. It is held in high reputation by Dutch engineers, the name trass being derived from a Dutch word signifying a binding or adhesive substance.

There is a great want of uniformity in the chemical composition of these volcanic products, which necessarily give rise to uncertainty in the composition and character of the supplies obtained, and their use is now to a great extent superseded by the substitution of hydraulic lime or cement.

HYDRAULIC CEMENTS.

The first hydraulic cements made in this country were obtained by burning natural cement stones, a patent having been taken out in 1796 for the preparation of what was improperly termed "Roman" cement from the calcareous clay nodules known by the name of septaria, which are obtained in considerable quantities on the Kentish and Essex coasts, the chief supplies being procured from Isle of Sheppey and the neighborhood of Harwich, were they are dredged up from the sea at low water. The composition of these nodules varies considerably, but they may be regarded generally as consisting of from about fifty to sixty-five per cent of carbonate of lime associated with argillaceous matter containing oxide of iron.

The Mulgrave cement made at Whitby from stone found on the east coast of Yorkshire, the Medina cement from the Isle of Wight, as well as various quick-setting cements made in different parts of the country, may be regarded as more or less partaking of the same character as the so-called Roman cement. The operation of burning these natural cement stones is a very simple one, but requires care and experience, the object sought to be attained being to drive off the carbonic acid from the carbonate of lime, and to cause the silica of the argillaceous portion of the stones to enter into combination with the lime, forming silicates that are capable of being readily attacked by hydrochloric acid. To effect this a very high temperature is not necessary, and should indeed be avoided, for many of these natural stones, if exposed to the same temperature as that which is employed in the manufacture of Portland cement, would undergo partial vitrification, and would no longer, when mixed with water, possess the setting properties of cement. The stone is burnt in a kiln worked on the intermittent system, and afterwards ground to powder, the quality of the cement depending upon a proper selection of the stone and the care taken in firing. The trade in Roman cement was at one time of so much importance that the question was raised whether foreign vessels should be allowed to dredge for the stone off the English coasts; but partly owing to increased supplies of material from which cement answering all the purposes of the original Roman can be prepared, but chiefly to its having been superseded by Portland cement for all purposes where strength and durability are required, the Roman cement manufacture has ceased to possess any especial interest. The cement known as Portland, which was so named from a fancied resemblance of blocks of this material to Portland stone, far exceeds in importance every other description of cement, both as regards the extent of the manufacture and the purposes to which it is applied. A patent was taken out for the manufacture of this material, in the year 1824, by Mr. Joseph Aspdin, a Yorkshire bricklayer, who states in his specification that he mixes powdered limestone and argillaceous earth in a fine state of division with water, then evaporates the water, and calcines the mass in a furnace until the carbonic acid is entirely expelled, and this is essentially a description of what is done at the present time. This was not the first attempt at the artificial preparation of hydraulic cement, inasmuch as so far back as 1810, a patent was granted to Edgar Dobbs, for burning a mixture of lime, clay, or any earthy material, for the manufacture of cement, and in 1818 another patent was taken out by Maurice St. Leger, for the use of a mixture of chalk or lime with clay or any substance consisting of silica and alumina; this mixture was to be made into a paste with water, dried and burnt in a kiln. For some time prior to Aspdin taking out his patent, the well-known French Engineer, M. Vicat, had been engaged in carrying out a series of experiments on the subject of hydraulic limes and cements, and an investigation of the subject was also undertaken by General Sir Chas. Pasley in 1826, at Chatham, who, in the course of his experiments, was the first to make use of the Medway blue clay, which has since been the principal source of the supplies of silica and alumina required for the manufacture of Portland cement in the chalk districts. It is a curious fact that in the early attempts to prepare Portland cement from artificial mixtures of clay and chalk, great care was taken to avoid too high a temperature in the kiln, and the light-colored underburnt pieces (such as are now returned back to the kiln to be more thoroughly calcined) were regarded as yielding the best cement. The first to establish works on the Thames for the manufacture of Portland cement was Mr. Frost, who, about the same time that General Pasley commenced his experiments, erected kilns at Swanscombe, which were subsequently transferred to Messrs. White Bros., who have since that time continued the manufacture. Some time afterwards a son of Mr. Aspdin established works in the same neighborhood at Northfleet, a place that is now almost entirely devoted to the cement trade.

For some considerable time the quantity produced was very small, whilst the quality produced was variable, and could not be depended upon, and so little was the new cement appreciated, that in 1833, whilst Roman cement was selling at 1*s* 6*d* per bushel, only 1*s* could be obtained for Portland. The trade has now become an important branch of national industry, every year new works are commenced, or old ones enlarged and supplied with new and improved machinery for saving labor, the demand for the article keeping pace with the increased supply. English makers are now so closely pressed, both as regards quality and price, by their German competitors, that it is only by exercising the greatest economy, and the production of the best quality, that they can hope to succeed in maintaining their position. The valuable qualities of this cement were early appreciated by the French engineers, and a large quantity of English-made cement was employed in the construction of the French docks and harbors.

The greater portion of the cement made in this country is manufactured at the numerous works situated on the Thames and the Medway, the materials from which it is prepared being simply chalk and clay. The upper chalk, or that in which flints most abound, is that which is employed on the Thames, the gray chalk which lies immediately below it being also used on the Medway.

The clay used for mixing with the chalk is obtained by dredging at low water on the banks of the Medway. Care must be taken in obtaining it that it is free from sand, and that it contains no fibrous vegetable matter; in the condition in which it reaches the work it contains about forty per cent of water. There is nothing very peculiar in the composition of this particular clay that should render its use essential for the manufacture of good Portland cement, the gault clay, as well as other descriptions of clay, being applicable for this purpose; any unctuous clay in which the proportion of alumina is considerable, that is free from sand and other impurities, and is capable of being reduced to a fine state of division, can be used for the manufacture of Portland cement. The clay and chalk in the proportion of three parts of the upper chalk or four parts of the gray chalk to one part of clay are thrown together, with a quantity of water, into a wash mill, which consists of a large circular trough (varying somewhat as regards character and size, but being generally about eighteen feet in diameter) in which the mixture is ground by means of a revolving beam to which heavy bars of iron are attached, to the condition of a fine semi-fluid mud, or "slurry" as it is termed. The slurry is then pumped up to be further ground, either between rollers or by horizontal stones, and passed thence to the drying floors.

Until within the last few years a very much larger quantity of

water was put into the wash-mill than is now generally the case, the slurry being pumped up into reservoirs or "backs" (as they are termed), where it remains until the mixture of clay and chalk, held in suspension by the water, had deposited, when the supernatant water was drawn off, and the slurry, as soon as it had attained sufficient consistency, had to be wheeled away in barrows to the drying stoves. This system necessarily involves a great deal of manual labor, besides a considerable loss of time, several weeks being required to allow the particles of clay and chalk to subside; this method was, moreover, not conducive to the uniformity of the mixture, owing to the tendency of the heavier particles to deposit before those which are lighter. It is now the custom in most works to put only just enough water into the wash-mill to make the slurry of a sufficiently-liquid consistency to allow of its being removed by pumps. The drying of the slurry, instead of being conducted as formerly in special ovens heated by coke, is now carried out in chambers erected on a level with the top of the kiln, these chambers being heated by the waste gases from the kiln, as they pass on to the chimney. The kilns in which the cement is burnt are closed at the top, the products of combustion being carried through the chambers containing the slurry, so that, as soon as the turning of a batch of cement in the kiln has been completed, a further quantity of slurry is sufficiently dried for another charge, and as this is already on a level with the top of the kiln, the operation of filling the kiln is facilitated.

The kilns ordinarily employed for burning cement are somewhat similar in their construction to those used in burning lime, and are generally worked on the intermittent system, the difficulty experienced in working ordinary kilns continuously being quite as great in the case of cement as it is in burning lime. The Hoffmann kiln, which is largely used in Germany for cement, has not been adopted to any extent by English manufacturers; this may, perhaps, be partly accounted for by the fact that, in the chalk districts, the dry slurry is always, to some extent, in the condition of dry powder, whereas the materials for German cements are generally mixed dry, and moistened with water, and then made up into bricks before firing.

The object to be attained in burning cement is not merely to drive off the carbonic acid from the chalk, and to effect the transformation of the silica of the clay from an insoluble into a soluble condition, but also to bring about those combinations of silica, alumina and lime, which require a very high temperature for their production, giving rise to a hard, almost semi-vitrified clinker. So far from being injured by being exposed to a very high temperature (as is the case with natural cement stones), Portland cement cannot be manufactured of full strength without being subjected to such a temperature, although it must not be so great as to produce actual fusion, for under such circumstances the material would be useless for cement. The conversion of the silica of the clay into a soluble condition will be found to have taken place in the half-burnt, yellowish pieces of cement that are returned to the kiln to be reheated, in which even some of the chalk is not calcined. The difference between a lightly-burnt cement and a well-burnt clinker would appear to be due to the action of alumina, and the part it plays in the formation of double silicates of alumina and lime, and aluminates of lime. It was shown by M. Frémy, many years ago, that aluminates of lime obtained by subjecting mixtures of pure alumina and lime (consisting of one equivalent of alumina with one, two or three equivalents of lime), to a very high temperature produce, when mixed with water, hydrated aluminates of lime, which not only possess the property of hardening under water, but are capable of binding together very large quantities of sand into a mass possessing the hardness of stone. In the Lias districts in Warwickshire the limestone (which is of a harder description than chalk), and the shales which take the place of mud, are passed through toothed rollers and ground to a fine powder by horizontal stones. The powder is mixed in a pugmill, with as much water as is necessary to form a soft paste of sufficient plasticity to be capable of being separated into pieces about the size of bricks which, when dried, are ready for the kiln.

When drawn from the kiln, the calcined cement is crushed between rollers and ground to a fine powder by horizontal stones of the same description as those used in flour mills. Since it is necessary in order to obtain the strong cements now demanded, that the mixture of chalk and clay should be heated to such an extent as to bring it into the condition of a hard clinker, the question of its being sufficiently ground has become one of great importance, on account of the difficulty experienced in reducing such a hard material to a very fine state of division. Unless the cement be ground fine its binding properties cannot be developed, and the quantity of sand it will bear mixing with is diminished. The coarse particles of cement which will not pass through a fifty-mesh sieve are totally inert as a binding material; they will not even adhere together, although they may be converted, by simply grinding to powder, into an excellent cement. There can be no doubt but that the finer a cement is ground, the better it is; it would, however, be manifestly impracticable to reduce a hard, well-burned clinker to an impalpable powder; the fineness must be limited by the cost of grinding. A few years ago a cement was thought to be sufficiently ground if eighty per cent would pass through a fifty-mesh sieve; now, however, it is required that ninety per cent should pass a seventy-six mesh sieve, or 5,800 meshes to the square inch.

When ground, the cement is conveyed to a store (the results of several day's grinding being mixed together so as to insure, as far as possible, uniformity throughout the bulk), where it should remain for three weeks or a month before being issued. However well made a cement may be, yet if it be mixed with water too soon after grinding, heat is generated, and it is liable to swell and crack; hence the necessity of making up small blocks, and observing whether any rise of temperature takes place on the addition of water, and whether, ubsequently, any cracks make their appearance. Cement, to set properly, requires an ample supply of water, and will sometimes, if applied to a very dry wall, not adhere to it properly from deficiency of water. It would appear that the benefit derived from immersion in water continues for a considerable period, judging from an experiment made with two briquettes of the same cement, one of which was kept three years in air, and the other in water. The one which had been kept in water gave the highest breaking strain, had a more crystalline fracture, and contained more water in chemical combination than the briquette that had been kept in air for the same period.

[To be continued.]

BOOKS AND PAPERS.

ANTOINE JEAN GROS[1] is an instance of a child born with a passionate love of painting. At eight years of age he covered his school-books with sketches, and at fourteen he entered the atelier of Louis David. His father being a miniature painter of some talent and a friend of Madame Lebrun, the child passed his days in the atmosphere of art. But the father was a prudent man, and, having known something of the difficulties of an artist's life, he was determined that his son should not enter upon it without having proved his vocation beyond any doubt. Accordingly, he took the boy to an exhibition of pictures and told him to chose his master from the works on view. Without any hesitation the child chose the "Andromaque," by David, and this early admiration for his master remained with him to the end of his life.

This *culte* for David (for it was nothing else) was, in a manner, the bane of Gros's life. Timid, depreciating his own powers, and unable to trust his own tastes, he leaned too much upon his master during the early and the later years of his career, and it was only the accident of meeting Napoléon, and being influenced by his strength of will, that made Gros follow his own instincts. He had no Classical tastes, he cared nothing for the doings of the Greeks and Romans, but the fashion of the day was for this kind of art, and so he followed in the stream. But the Revolution came upon him like a thunderclap. Naturally nervous, losing his father and his fortune, the terrors of the guillotine made him utterly unable to continue his lessons and other work, and so he induced David to get him a passport. This the elder man easily did by telling the section of the Tuileries that his pupil wanted to perfect his studies in Rome, and so, in January, 1793, Gros quitted his mother and his native city. Before this he had had a hard time of it in painting portraits (amongst others, some of the members of the Convention) at 6 francs a head!

Meeting Joséphine at Genoa, they became acquainted, and, upon Gros showing her some of his portraits, Madame Bonaparte, as he calls her, was so struck by his talent (or himself, for he was very handsome) that she persuaded him to accompany her to Milan to be introduced to the General. Napoléon greeted the young man with affability and agreed to sit for his portrait, and, also, upon the suggestion of Joséphine, attached him to the Commission for despoiling Italy of her works of art. But his dreams of painting the heroic were not yet carried out. Fettered by poverty, and after some time deserted by most of his friends, who had returned to France, he determined to leave Italy and rejoin his mother.

Once more in Paris, Gros was filled with enthusiasm for the exciting scenes of Napoléon's battles. His mind was full of war and heroic deeds, and so, when a competition was opened amongst twenty artists for a "Battle of Nazareth," he naturally put out all his strength. He obtained the commission, but after being installed in the Salle du Jeu-de-paume at Versailles, and after making divers sketches, the work was stopped by the First Consul, who, it was thought, could not permit his rival, Junot, to be immortalized. This may be so; Napoléon was mean and envious and jealous, but surely not to this extent, though, perhaps, at this early stage of his career, he may not have felt strong enough to be magnanimous. At any rate, he was generous to the artist, if not to the commander, and, to compensate Gros for the loss, he ordered him to paint his visit to the plague-stricken in the hospital of Jaffa. This picture, now in the Louvre, illustrates the heroism of Bonaparte in a new light. All the world had heard of his prowess, let them also see that he feared the contagion of fever no more than death on the battlefield! But if Napoléon intended the work to consolidate his reputation, it was certainly the means of laying the foundation of the painter's.

Gros' next work was the "Battle of Aboukir," a picture full of movement, which quality, added to a perfect knowledge of the horse in action, was this artist's special *forte*. But the "Battle of Eylau," now in the Louvre opposite the "Pestiférés de Jaffa," is his greatest work. Full of dramatic power and rich in color, it conveys to the

[1] "*Les artistes célèbres: Le Baron Gros,*" par G. Dargenty. Paris, Rouam.

spectator's mind the horror and brutality of war; one feels that the conqueror (arrayed like a fop in a gray satin coat trimmed with fur), may, for once in his life, have sincerely felt the truth of his own words the morning after the battle: "*Ah! si les rois pouvaient contempler ce spectacle, ils seraient moins avides de conquêtes.*" But even the misery of Eylau, the blood trailing over the snow, the wounded men frozen to death, the horrors which even make one shudder when gazing at Gros' picture, were not sufficient to stay the ambition and lust for blood in this barbarian, though seen in the increased horror of reality.

Gros was the first unfortunate painter to undertake the decoration of the Panthéon. Napoléon desired to be one with the other sovereigns of France, and so we have a design for the biggest dome of Paris, which groups him with Clovis, Charlemagne, and St. Louis! The best part of the work is the central group of winged spirits; but the arrogance of Bonaparte knew no bounds. Whereas St. Louis, his wife, Charlemagne, Clovis, Clotilde, and even Marie Thérèse are all kneeling, he and his son stand and sit! The history of this picture is curious. Begun in 1812, Gros was to finish it in eighteen months, and to receive 36,000 francs in payment. But 1814 arrived, and found it unfinished; and so Louis XVIII and the duchesse d'Angoulême were substituted for Napoléon and Marie Thérèse, Gros receiving an extra 15,000 for his trouble! In 1815, the Emperor returned in the flesh, and naturally Gros was ordered to replace his spirit upon the cupola of the Panthéon. Again Louis XVIII disappeared; but alas! so did Napoléon after Waterloo, and the King once more eclipsed the emperor. Louis Napoléon left him in his glory, and the Republic hitherto has not thought it necessary to make any change in the heights of the building, preferring to decorate their great men's temple with scenes from the lives of the saints. Perhaps we may yet see these replaced by less legendary beings with subjects taken from the lives of the "Grands Hommes" to whom the country is so grateful! We devoutly hope not; the Panthéon has suffered enough already from the follies of party politics and men's evil passions, and deserves to be left in peace for the future.

With the downfall of the Empire, came the decadence of Gros as a painter. Louis XVIII tried to patronize him; but the world was sick of bloodshed and heroism of the modern type, and Gros fell again under the influence of David's classic tastes. There is something very touching in the adoration of Gros for his old master, and we find him endeavoring to carry out David's wishes to devote himself to "*la grande peinture.*" David was in exile in Brussels, and so much correspondence upon the subject took place between them. The master thoroughly believed in the pupil's talent, and the pupil had perfect faith in the master's wisdom. But they both erred. David's notion of grand painting was, that no subject was worth treating out of Classic history. He talks of Gros undertaking a great historical picture; but he tells him to study his Plutarch, his Æschylus, Sophocles, Euripides, and his Bible! Nothing more modern was grand. Nothing which stirred the hearts of living men and women was heroic. The struggles of the Republic for freedom, and the battles of the Empire were mere child's play compared with similar events in ancient history. And so we find the docile pupil erring as did his master; for both painters are now valued for their modern work — David for his portraits, and Gros for "Eylau" and "Jaffa." Who can now bear the staginess of the classicisms of either painter? And thus the end of Gros' career was wrecked. There was a slight episode in his downward career which gave him some comfort, the enthusiasm of Delacroix (then a young man) for his battle pictures; and much of the latter's work was modelled on that of Gros; indeed there is no doubt that Gros influenced all the younger realistic school besides Delacroix and Géricault. Whether M. Dagenty is right in placing Gros higher than Géricault, we are in no wise sure; we may be wrong, but to us the latter's "Naufrage de la Méduse," is the grandest picture of the French school of that period. We also prefer Géricault's portraits to Gros'; but all these three men deserve the thanks of the present generation, in breaking through tradition, and making painting the interpreter of men's minds and hearts.

Had Gros possessed more self-will, had he had more confidence in himself and his own instincts, he never would have incurred the ill-nature of his critics. As it happened, the devotion of his wife and his numerous pupils were not enough to keep him from suicide. Bonaparte was exiled, David had died in exile, consequently he had no one to lean on. In spite of the sympathy of his friends, he could not get over the criticism of his enemies; as he pathetically remarked: "*Puisque je ne suis plus bon à rien je n'ai plus qu' à me jeter à l'eau;*" and so one morning he drowned himself at Meudon, near Sèvres, the victim of the critics. Posterity has given him an honorable place, as the founder of a new school, which includes amongst his immediate pupils, Delacroix, Bonnington, Breton, Couture, Lami, Moreau, Rousseau and Leprinee; and in this generation, a whole army of modern realists.

FIRE RECORD FOR AUGUST.—The *Daily Commercial Bulletin's* fire record for August shows a total loss in the United States and Canada of $8,317,500, against $13,000,000 in August, 1886. The average August losses for ten years have been about $7,000,000. The total losses for the first eight months of 1887 are $85,245,600, against $76,900,000 for the corresponding period of 1886.

COMMUNICATIONS

ANOTHER ARCHITECT'S TROUBLES.

September 2, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — Will you kindly give us your opinion on the case stated below:

A asks B, an architect, to draw him plans of a frame house to cost $3,000. B prepares preliminary sketches and submits them. These are altered by A's desire, and three different sets of plans submitted. In all these a house can be put up in a plain style for the $3,000. Finally, plans are adopted, and expensive interior fittings ordered to be specified for, such as mullion windows in four rooms, seven windows to open to floor, three windows entirely of stained glass and five border lights, front door half-stained glass, Conway's champion sliding blinds for main windows, two double and four single Davis-patent hanging and sliding doors, red-wood mantels, electric bells, speaking-tubes, bath-room fitted with patent closet, etc. A picturesque roof with three gables, fancy shingles, also insisted upon by A's better half, who had formed her ideas from Shoppell's house plans, and thought she could command these conveniences for a moderate sum. The height of the stories was 12′ 6″ and 12′ 0″ respectively, more air being required here than in a northern climate. B warned A that these additions and fittings would run up the amount to far above the sum originally named. A nevertheless instructed B to draw up the plans and specifications to the full extent of these additions, etc., and that, should the builders estimate be higher than $3,000, certain parts of the house shall not be built, but struck out of the plans, so as to lower the cost to the desired sum. The plans and specifications were finished and delivered to A on August 8. Hearing nothing from A on the subject, on August 31, B sent in his bill for two and one-half per cent on the estimated cost of the house, $3,000 — no superintendence. On September 1, B received a curt note from A that he returns herewith the plans and specifications, as they are of no use to him, as the house cannot be put up for the money, *i. e.*, $3,000.

Is B to be summarily dismissed in this manner and deprived of payment of his work, or has he a case for a suit at law to recover charges for the plans, etc.?

JUSTICIA.

September 9, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — We forwarded you a case for your opinion on September 2. Since that date an important fact has been discovered. A returned, with a letter, "the plans and specifications" referred to in the case submitted. On B examining the parcel he found a copy of specifications printed with a type-writer, giving A's name as the person for whom the house was to be built, also B's name as architect. This type-writer copy was, however, not a correct copy of the original given A by B, but contained many important additions and alterations, such as fencing, back-closet, boiler, hanging-doors, alterations of sizes of windows, reeding, etc., thus adding several hundred dollars to the cost of the building. These specifications are signed by A. B knew nothing, was not notified of these additions, etc., but A gave the specifications so amended by him to two builders for estimates. This conduct appears to B to be, if not criminal, something very near it. It will damage his reputation as an architect beginning business, the specifications so altered being false, and not the ones prepared by the architect. The original has not been returned.

We do not desire our names to appear in print, but wish the case to be from "JUSTICIA."

[WE should hesitate to say that A had deliberately falsified B's specification for the purpose of defrauding him. The case looks like one of those very common ones where an arrogant, overbearing client thinks he can bully a young architect into getting him bath-rooms and other extras for nothing, and, if he is disappointed, can do as he likes about paying the architect's bill. If B, as he says, having the limit of cost given him, made plans of a house containing substantially the accommodation required, which could be erected in a good and workmanlike style for a price within the limit; and if he then, when A proposed changes and additions, warned him that these would add materially to the expense, he has done all that is required of his professional skill, and would, we think, have no difficulty in collecting at law the usual fee for the drawings and specifications of the original house, besides a fair compensation for the extra work involved in studying and arranging for the additions which he was directed to make, and in modifying the drawings and specifications accordingly. — EDS. AMERICAN ARCHITECT.]

HOW TO BUILD AN ICE-HOUSE.

September 6, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — It is desired to build an ice-house to hold 1728 cubic feet of ice. We want battering cobblestone walls with conical roof.

1. Should floor (of concrete) be above level of ground?

2. Should walls be solid or hollow? If the latter, would a four-inch inner brick wall bonded with outer wall by frequent hoop-irons across a three-inch air space suffice?

3. Should roof be of solid plank, or with rafters and air-spaces?
4. What is better for roofing, shingles or slate?
5. Is ventilation desirable?

Respectfully yours, Judah.

[1. The ice-house floor should be above the level of the ground, or, at least, should be sufficiently above some neighboring area to give an outfall for a drain, put in in such a way as to keep the floor clear of standing water.

2. The walls should be hollow. A four-inch lining-wall, tied to the outer wall with hoop-iron, and with a three-inch air-space, would answer, but it would be better, if the air-space is thoroughly drained, to fill it with mineral-wool, or some similar substance, to prevent the movement of the air entangled in the fibres, and thus check the transferrence by convection of heat from the outside to the lining-wall.

3. A roof of thick plank will keep out heat far better than one of thin boards with an air space under it.

4. Shingles will be much better for roofing than slate.

5. It is best to ventilate the upper portion of the building. If no ventilation is provided, the confined air under the roof becomes intensely heated in summer, and outlets should be provided at the highest part, with inlets at convenient points, to keep the temperature of the air over the ice at least down to that of the exterior atmosphere.—Eds. American Architect.]

CORRECTIONS.

To the Editors of the American Architect:—

Dear Sirs,—Your reviewer of the life of La Tour has fallen into a curious error in saying that he was "drawn into *companionship* with such artists as Van Dyck, Watteau and Desportes, all of whom influenced him very much in after life." Van Dyck died in 1641—*sixty-three years before La Tour was born*. Watteau died in 1721, and was ill some time before his death, which occurred when La Tour was only seventeen years of age, so that their "companionship" must have been of a very limited kind.

Yours faithfully, Penguin.

Providence, R. I., September 19, 1887.

To the Editors of the American Architect:—

Dear Sirs,—Will you please make correction in the next issue of the *Architect* in regard to the location of the Barrington Town-hall? Please note that the drawing says "Barrington, R. I.," while the text says "Great Barrington, Mass."

Yours truly, Stone, Carpenter & Willson.

NOTES AND CLIPPINGS

Wages in 1800.—The condition of the wage class of that day may be well examined; it is full of instruction for social agitators. In the great cities unskilled workmen were hired by the day, bought their own food, and found their own lodgings. But in the country, on the farms, or wherever a hand was employed on some public work, they were fed and lodged by the employer and given a few dollars a month. On the Pennsylvania canals the diggers ate the coarsest diet, were housed in the rudest sheds, and paid $6 a month from May to November, and $5 a month from November to May. Hod-carriers and mortar-mixers, diggers and choppers, who, from 1793 to 1800, labored on the public buildings and cut the streets and avenues of Washington city received $70 a year, or, if they wished, $60 for all the work they could perform from March 1 to December 20. The hours of work were invariably from sunrise to sunset. Wages at Albany and New York were three shillings, or as money then went, forty cents a day; at Lancaster, $8 to $10 a month; elsewhere in Pennsylvania workmen were content with $6 in summer and $5 in winter. At Baltimore men were glad to be hired at eighteen pence a day. None by the month asked more than $6. At Fredericksburg the price of labor was from $5 to $7. In Virginia white men employed by the year were given £16 currency; slaves, when hired, were clothed and their masters paid £1 a month. A pound Virginia money was, in federal money, $3.33. The average rate of wages the land over was, therefore, $65 a year, with food, and perhaps lodging. Out of this small sum the workman must, with his wife's help, maintain his family.—*McMasters's History of the United States.*

The most Elevated Church in Europe.—"The very highest church in Europe," according to the *Bundner Tagblatt*, "is the pilgrimage chapel of St. Maria de Ziteit, above Salux, in the canton of Graubünden. It lies 2,434 meters above the sea level—nearly 8,000 feet high, above the forest, near the limits of perpetual snow. It is only open during the summer-time of that region—or, as the folks thereabout reckon, from St. John the Baptist's Day to St Michael's Day—and is used only by the Alp herds, who remain there through the summer with their cows and goats, and occasionally by hunters in search of the chamois and marmot. All the inhabitants of Salux climb up thither on midsummer day to assist at the first mass and hear the first sermon of the year, and there is also a crowded congregation on Michaelmas Day, at the last service of the year. From time to time a few stray pilgrims from the Graübunden Oberland and the Tyrol find their way here. The second highest church probably in Europe, that of Monstein, also open only in the summer, belongs to Graubünden. At our visit the hale old preacher had five foreign tourists for his congregation."

Charleston since the Earthquake.—During the year since the earthquake in Charleston, between 5000 and 6000 buildings, exclusive of churches and public buildings, have been overhauled and restored, and in some cases put in better condition than before. In addition to these, 141 buildings have been remodelled or rebuilt merely for improvement's sake. New buildings to the number of 271 have also been erected, to meet the growing demand for residences and places of business. Not less than $3,500,000 has been expended in the work of restoration and improvement.—*Boston Journal.*

TRADE SURVEYS

Notwithstanding the volume of currency has been doubled within ten years there are numerous symptoms of an approaching scarcity. Since that time railroad mileage has been nearly doubled, and manufacturing capacity has increased fully as much. A thousand towns and cities have sprung up, most of them in the West and South, creating demands and markets. The population has scattered into the newly-developed regions, and have thus greatly increased agricultural productions and have opened up new markets for manufactures, fuel, lumber, clothing, etc. Land values have expanded enormously, and necessities have arisen all over the country for more money. The elasticity of our financial system does not seem equal to the rapidly-expanding requirements of business, at least if the views which seem to be seriously entertained by numerous reputable financiers and financial writers are to be accepted at par value. There does seem to be good reason for apprehending a financial stringency sooner or later which will bring more than usually serious consequences. The banks are loaned up. Individual lenders are pretty well exhausted. It is argued and believed that the requirements for money will continue to grow as rapidly in the future as in the past, and if so it is said that a stringency is inevitable. Among the methods suggested to alleviate the attendant ills is the loaning of the Government cash at two per cent on bonds deposited as security; a sort of resurrection of the discarded greenback doctrine. The two causes of existing conditions from a financial standpoint are the appreciation of values and the greater needs of the country. Both causes may, but one is certain to continue to act. A general decline in values is not impossible. Several recent symptoms have manifested themselves, but with labor where it is, no material decline is possible, and nothing but a national depression which would disorganize and idle a large part of our laborers would reduce the cost of labor. The pressure for money will increase as soon as circumstances clearly demonstrate that the volume is insufficient. Trifles have done this in our past history and may do so again. One of the first results of such stringency would be the abandonment or curtailment of future enterprises. An immense amount of capital is to be invested next year and year after in enterprises, many of which will not be productive for two or three years after. Wild guesses have been made recently as to the volume of invested capital not yet productive, and it is put at one thousand millions as a sort of swinging point. Shrewd financial managers recognize the time is near at hand when it will be wiser to have ready cash in vaults to seize titles of sinking tradesmen, stock-holders, bond-holders, and investors, than to have it slowly earning its two to six per cent dividends. And if reports are true, upwards of fifty million dollars have been already locked up in view of a stringency, which policy aggrevates the anticipated disease. The great body of the people, who make and exchange values have, for ten or more years, neither had the occasion nor the time to study matters like these, but it looks as though circumstances were conspiring to draw them to the consideration of the problem. The banks cannot much longer meet the increasing demands without calling in loans which it would be impolitic for them to do. The Government can lend very little additional assistance without the inauguration of a policy which requires the nerve and intelligence of a bold, well-balanced head. There is a remedy, but there must be a strong public sentiment to secure its application, viz., the hypothecation of bonds with the Government for cash, yet, as heretofore said, the alarms raised as to immediate dangers are unnecessary. The power of adaptation to circumstances is characteristic of the American people. A stringency of money for a week or month does not necessarily involve disaster, but it does involve a restriction of work. Even a general curtailment of activity is not the worst evil that might befal this nation. We have six days for work and one for rest in the Christian week, but in the commercial and industrial weeks, as measured by years, we have no Sunday. The tendency to artificial values sometimes needs checking. The advancing rates of money, if maintained, will plant a plentiful crop of evil. Our decade of prosperity has been largely due to low rates of interest and reasonable cost of labor These strong props have been weakened within the past two years, but stimulated enterprise fails to take note of it. Perhaps then the critic says a stringency is desirable. Not in the least, because other remedies are at hand than those which are born in the throes of bankruptcy, limited or widespread. The much-talked-of dangers from financial stringency are, however, overdrawn. If it comes good will follow; if it is avoided, as it can and will be, greater national strength and endurance will be gained. The industries show no sign of the storms in the clouds. The distribution of merchandise was never greater. Railroad companies cannot furnish sufficient rolling stock, and the car-builders are working by electric lights. A few railroad companies who mapped out extraordinary work for next year have voted delay on some of their projects, but there are scores of other and anxious railroad projects awaiting the helping hand of the domestic or foreign capitalists. In British and European manufacturing channels there is less depression and better prospects, though the conditions there forbid robust industrial health; hence there is a constant outflow of skilled and unskilled labor to the States which promises to prevent a rise in the cost of labor, no matter to what extent labor may be organized. The trades-union movement is increasing among the laboring classes, and the spirit of organization is still thoroughly awake, though the leadership has enforced more conservative views. The anthracite miners have this week secured the first victory they ever secured in inducing the leading companies and individual operators to arbitrate and advance wages eight per cent, besides agreeing to a sliding scale. The coke-workers are still toying with the scale, and a general strike is desired by the leaders who felt themselves out-generaled last spring. The iron and steel workers are quiet, and mills and furnaces were never turning out a greater product. The lumber manufacturers have a market for all the products of their mills and are not jeopardised with unmanagable stocks. The shop and factory capacity of all kinds East and West is crowded, but competition is taking the poetry out of business in some directions. Trade combinations multiply, but consumers' interests are not threatened. There is a strong outside contingent in every trade and industry of independent producers who cannot be controlled, and who serve to check radical action among the organized interests. Farmers, planters, manufacturers and miners are all doing well. Railroad interests, store-keepers and jobbers are all as busy as their energies allow. Collections are good. Losses are few. Stocks are light, and the future prospects are such as to keep a broad grin of satisfaction on the countenance of Uncle Sam.



A VIEW IN JAPAN.

HELIOTYPE PRINTING CO. BOSTON.

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CONTENTS

WITHIN a year or two it has occurred to some one to make excavations in the forbidding-looking desert on the top of the Athenian Acropolis, and many curious discoveries have been made. Judging from the character of the objects found, it is conjectured that after the first and most successful attack of the Persians upon Athens, during which they burned and overthrew nearly all the sacred buildings on the Acropolis, the Athenians, in their haste to rebuild them in more beautiful form than ever in commemoration of their final victory, must have used the debris and rubbish on the ground for filling hollows and levelling the rocky, broken site for the reception of the great works of Ictinus. Although the sacred statues were undoubtedly removed from the ruins and well cared for, the temples are known to have contained scores, or more probably thousands of votive offerings in the shape of images of greater or less size, which, being manufactured by wholesale, just as silver hearts and other objects are at the present day for devotees to hang up in the pilgrimage churches, had very little value in the eyes of the Athenian engineers, and were used, with other broken rubbish, as filling for the depressions of the ground. There they have remained undisturbed for twenty-three hundred years, and great quantities of them are now brought to light in the excavations. They appear to belong in general to the period from 525 to 500 B. C., and many of them are rather dolls than statuettes, the arms being often jointed, while the whole figure is almost invariably painted. According to Mr. Ernest A. Gardner, who is quoted in the *Builder*, the effect of the coloring is "pleasing." We must say that our own faith in the color-sense of the ancient Athenians has been a good deal shaken by experience, and, although Mr. Gardner's description of the painting of the figures is interesting, we reserve our enthusiasm as to the effect of the decoration. According to him, the color is "never applied in mass to a broad, flat surface, but a small, visible portion of an undergarment is usually colored, and the white marble of the draped portions is relieved with patterns and borders in dark green, dark purple, red or blue," after the manner, we suppose, of the plaster figures of Christ in the windows of dealers in Catholic ecclesiastical goods. Unlike these, however, which have the faces and hands painted pink, the "carnations," or nude portions of the Greek statues are left white, with the exception of the hair, which is always of a reddish brown, and the lips and the iris of the eyes, which are painted red. We must be forgiven for thinking that a white marble statue with auburn hair and red lips and eyes, although it may possess what Mr. Gardner calls a "richness and harmony of effect," must leave something to be desired in the way of expression, if not of coloring, and, although we are earnestly called upon to prefer this "entirely honest" style of representing nature to the despicable one of "hiding true surface" by painting it all over, we are still childish enough, if we are to have dolls at all, to prefer the naturalistic sort, whatever may be their want of sincerity, to figures with marble countenances and pink eyes.

IT is pleasant to find architects in England taking an important part in the promotion of general technical education. Not long ago a meeting was held in London, in the house of Mr. E. C. Robins, at which a large number of architects, besides the distinguished host, were present, with many other guests, while Professor Huxley, whose contempt for untechnical architects is well known, presided with a grace which seems to indicate that he retains a suitable respect for those members of the profession who like to understand thoroughly the art to which they devote their lives. The principal business of the meeting was to listen to an address by Professor Ayrton, on the Technical Training at the Central Institution, a school of applied science established at South Kensington by the Institute of the City and Guild of London, of which Mr. Robins is an active member. It is hardly necessary to say that Professor Ayrton's address was clever and suggestive, and his remarks on the importance of such training to architects were particularly just. Speaking of the matter of heating and ventilation in buildings, he said that he could not see why it should not be as easy to obtain and teach accurate practical rules about the flow of heat and air as about the course of electrical currents, yet, while electrical conductors by the mile are set up every day in the most complex relations without the suspicion that the current in any one of them would be found to flow in a different direction from that anticipated by the engineer, conducting pipes for warm and cold air are continually put up under the direction of architects, which act as inlets where they were designed to serve as outlets, or *vice versa*, or perhaps content themselves by producing total stagnation. "Hence," as he said, "the professional constructor of ventilating and warming appliances is certainly at present far behind the electrical engineer."

WE know well enough that many architects will say indignantly that they are "artists, not professional constructors of heating and warming appliances," and that they should not be blamed if the air in their ventilating shafts moves occasionally in the wrong direction; but, although this attitude is understood in the profession, it is every day becoming more and more incomprehensible to persons outside the profession. As Professor Ayrton went on to say, if the closeness or chilliness of certain public buildings comes from the imperfect technical knowledge of the architect who designed the heating or ventilating apparatus, it is for the interest of architects that they should get a better knowledge of the subject as soon as possible, and this is nearly the unanimous sentiment of persons outside the profession. The idea prevalent among the older architects, rather than the more modern generation, that the application of the Five Orders to building is an art so vast and noble that the mind which grasps it cannot contain anything else, finds no sympathy in the outside world, and the architect who does not know how to warm a house comfortably, or supply its rooms with pure air, is looked upon as only half instructed. Whether the technical knowledge which prepares a young architect to do this sort of work well helps or hinders him in designing pretty things we will not inquire, having no desire to enter into that perennial controversy; but as we have seen a great many beautiful buildings which were perfectly well ventilated, and a considerable number of ugly ones which were badly ventilated, we infer that the two kinds of skill are not totally incompatible; and in this case the architect who combines the two in the highest degree is pretty certain, in the present age of the world, to secure the most employment.

WE know of only two or three buildings specially constructed in this country for the use of architects in their professional work, and they seem to be equally rare abroad. The rule with us is for the architect to hire rooms in the busiest quarter of some city and carry on all his affairs there, leaving his office at night for his home, to which he is very apt to carry some work in the way of sketching or specification-writing

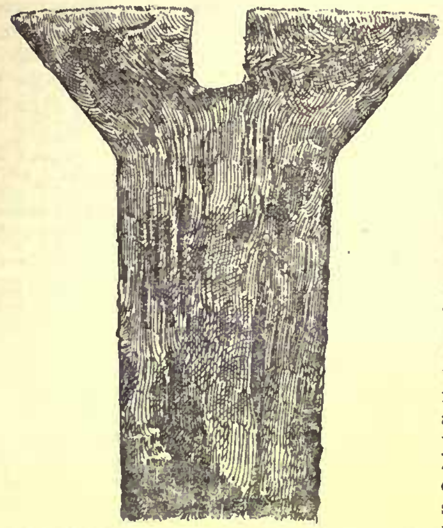
to occupy the evening, and the late Mr. Richardson was the only American architect in extensive practice, so far as we can remember, who carried on his business in his own house, adding, as occasion required, rooms for his assistants in a wing of the building. This way of conducting affairs, which has much to recommend it, independent of the consideration that the rent of a separate office is usually enough to pay the salaries of one or two good draughtsmen, is, we need hardly say, the usual method abroad, where the architect makes his drawings and receives his clients in his own house or apartment. Occasionally, where a man's business is too large to be accommodated in two or three rooms of a dwelling-house, a Paris or London architect will go to the expense of hiring offices near the centre of the town, but this is quite exceptional. In Berlin, where some of the best architects have now an immense connection, the noted firm of Kayser & Von Groszheim, after carrying on for many years a business which has brought it to the highest reputation in the attic rooms of the two adjoining dwelling-houses occupied by the members of the firm, has just erected in the neighborhood a building designed throughout for the accommodation of their professional work, which we find illustrated in the *Deutsche Bauzeitung*. Except the janitor's apartment of two rooms, the entire structure is occupied for drawing or business. The house, above the basement, is divided into seventeen rooms, three of which are occupied by the chief draughtsmen, while the others, with the exception of a small "conference-room" in each of three stories, and a large library in the first story, are devoted to drawing. In the story under the roof a large space is given up to the reproduction of drawings by photographic processes, for which a large dark chamber is provided, together with a work-room, and a "plateau" for exposing prints under cover.

A PICTURE-SALE took place not long ago in London, in which, although the collection consisted wholly of modern paintings brought together by a private gentleman of Glasgow, the average price realized for the pictures is said, by the *British Architect*, to have been about the highest on record. The owner, Mr. Graham, certainly deserves the credit of having bought with remarkable taste, and appears to have reaped the usual reward of discrimination in such matters. The place of honor at the sale was occupied by a picture by Gainsborough, two portraits of "The Sisters," which was bought by a dealer for fifty thousand dollars. Another picture, by Turner, a seapiece, was purchased for thirty-four thousand by the same dealer, who bought another Turner picture, "An Italian Landscape," for nearly six thousand dollars. This dealer, Mr. Agnew, who purchased about one hundred and fifty thousand dollars' worth of the pictures, or nearly one-half in value of the whole collection, bid twelve thousand and seventy-five dollars for a picture by Sir Joshua Reynolds, which he had himself bought for thirty-one hundred and fifty dollars ten years ago, and had sold to Mr. Graham. It is hardly likely that Mr. Agnew would not know the market value of such articles, and we can only infer that a picture of the first class, bought as an investment, may increase four-fold in value in ten years. One of Sir Edwin Landseer's beautiful little pictures, two feet square, brought fifty-three hundred and fifty dollars, or nearly as much as a huge canvas by Millais, five and one-half by seven feet.

THE Government managers of the new city elevated railway in Berlin have, according to *La Semaine des Constructeurs*, taken a great deal of pains to diminish the noise of trains passing over the viaducts and bridges, which, of course, form the principal portion of the road. Wherever possible, the viaducts are built of brick or stone, and the sound of the light trains running over these is not very annoying; but arches of masonry cannot well be used in crossing crowded streets, and the metallic structures employed in such places rattle and reverberate in a manner which is considered very suitable to the nerves of the people of New York, but which the Germans are not disposed to endure. In experimenting to find means for overcoming the trouble, it is found that the form of the bridge does not perceptibly affect the noise from it, a lattice truss, notwithstanding the multiplicity of joints, producing no more sound than a plate girder, but the length is a very important factor, so much so that the noise is considered by the German engineers to be directly proportioned to the span of the bridge. Where the rails rest on wooden cross-ties, or on timbers running longitudinally, the sound is less than where they are secured directly to the metal, and it may be still further diminished by placing cushions of felt or rubber under the timbers before bolting them to the bridge construction. To cover an iron bridge entirely with planking does not appreciably diminish the noise from it unless the planking is covered with gravel, a thin layer of which has a marked deadening effect, while still more improvement is obtained by thickening the layer of gravel about the track so as to bury the cross-ties or longitudinal timbers on which the rails rest. Profiting by these suggestions, the Berlin engineers have adopted two different systems for diminishing the noise of trains on their viaducts. One is to bolt to the bridge-structure long troughs of sheet-iron, about sixteen inches wide, so arranged that a rail will come in the centre of each. The troughs are then filled with gravel, in the middle of which is buried the longitudinal timber carrying the rail, and the space between the troughs is covered with iron plates on which is spread a thin layer of gravel. The second method, which is found to be more efficient than the other, consists in placing a continuous series of shallow iron troughs, about five feet square, along the line of the tracks. These are filled with gravel, on which the ties and rails are laid.

DR. HECTOR GEORGE, who has a faculty of collecting interesting observations on physiological subjects, writes an article in *Le Génie Civil* on venomous animals, much of which is useful, as well as curious. As every one knows, the most dangerous creature of this sort in Europe is the viper, a small snake, which is found in all parts of England and the Continent, and, although less venomous than our common rattlesnake, is an animal to be carefully avoided. According to Dr. Viand-Grandmarais, who studied the effects of viper-bites in Brittany, and collected statistics of three hundred and sixty-two cases, sixty-three of those bitten, or nearly one-sixth, died from the effect. The character of the viper-poison seems to be nearly the same as that of the rattlesnake. The person bitten feels little pain, but after a time becomes faint, and often loses consciousness entirely. Then distress comes on, with cold sweats and nausea, the action of the heart grows feeble and slow, sometimes falling to twenty-eight pulsations a minute, and the patient dies, unless the constitution is strong enough to resist the effect of the poison, until it begins to abate. The remedies are also the same as those for rattlesnake bites; sucking the venom from the wound, which is the most effectual portion of the treatment if quickly employed, and large doses of strong, hot whiskey or brandy. The alcohol is said to act both as an antidote to the venom, and also, particularly if the liquor is taken hot, by its effect in producing a copious perspiration, which seems to aid in eliminating the poison, and, apparently for the same reason, ammonia, which, when taken internally, causes perspiration, has been found beneficial. Singularly enough, the Italian peasants long ago discovered that the poison of the enormous spider of Tarentum, may be eliminated through the skin, and when one of them is bitten by a tarantula, his first thought is to work himself into a profuse perspiration by the mad dance which has been the subject of so many romances, and has inspired so much music. Next to the vipers, the bees and wasps, small and unromantic as they are, seem to be the most efficiently armed of European animals, and many children, and even strong men, have fallen victims to their attacks. As a rule, the stings of these insects are fatal only when many are inflicted at once, but a single one occasionally causes death. The sting of a bee on the temple has been known to kill a man in ten minutes, and a child of six years, stung in the same place, died in half an hour; while men, stung on the eyelids, or in the nose, have died in a few minutes. The most vulnerable spot is, however, the neck, and the sting of a bee or wasp in that place often causes death by suffocation, through the swelling of the tissues, and the consequent closing of the wind-pipe, in a few seconds. Where a large number of the insects attack a person, death is not unfrequently caused by the mere pain, which causes a fatal shock to the nervous system. During the French and Prussian war, at the battle of Beaumont, a bee-hive within the German lines was overturned by a shell, or some other projectile. The bees rushed out and fell upon the soldiers near by with such fury as to kill four of them on the spot, while four more died soon afterward from the effect of the stings, and several others were rendered helpless for months.

ADHESION OF NAILS, SPIKES AND SCREWS IN WOOD.

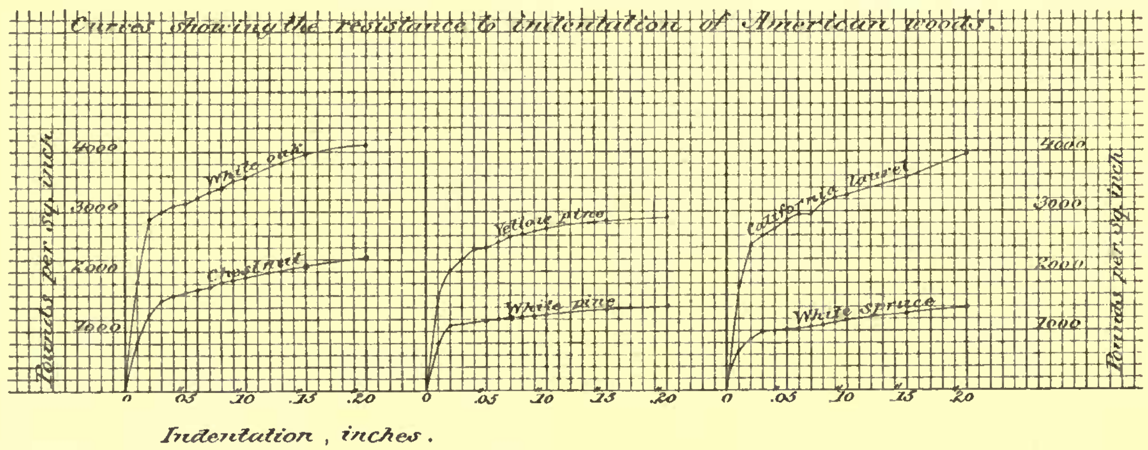


Magnified sectional view of the head of a wood-screw, showing the distortion of the fibres of the iron occasioned by upsetting during manufacture.

FUNDAMENTAL in the adhesive resistance of nails and screws is the friction between the surfaces of the metal and the wood which are in contact, in addition to which, at times, the shearing and transverse strength of the wood influences the results, also the strength and stiffness of the nails.

Taking the most simple case at first, in which a nail is driven into the wood by carefully-directed hammer-blows and then pulled out in the direction of its length, friction alone causes the adhesive resistance. In driving the nail, the fibres of the wood are both displaced and compressed, and in their efforts to recover from the compression, there is exerted a pressure against the sides of the nail, the amount of which depends upon the extent to which the fibres have been compressed and upon the quality of the wood. As will be shown, however, it does not follow that twice the compression of the fibres will cause twice the pressure against the nail, within practical limits the pressure not increasing in the same ratio that the wood is compressed.

This will be made clear by referring to another kind of tests which will be briefly considered before entering upon the discussion of the behavior of the nails themselves in the wood; namely, indentation tests. They consist in subjecting a part of the surface of a stick of timber to compression-loads acting on a flat-faced plunger, and ascertaining the loads required to indent the wood different depths. The accompanying diagram, plotted from the results of some indentation tests made at the Watertown Arsenal — see Report of 1883, which contains a very exhaustive series of experiments upon the strength of North American woods — illustrates the behavior of several kinds of wood tested in the manner above described. These curves fairly represent their respective species, although there is a wide range in the strength of the wood from different trees, and even in different parts of the same stick. Consequently, it is difficult to correctly estimate the strength of timber within narrow limits, although the observance of certain characteristics of good timber will aid very much in this direction.



The fact that hard woods require more pressure to indent them than soft woods requires no comment; it will be observed, however, that in the diagram both woods give a very steep curve at the start, the resistance increasing rapidly till the indentation reaches two to three-hundredths of an inch, after which the top of the curves become somewhat flat, indicating a considerable yielding of the wood without much increase of pressure. These tests are very useful, in showing the possibilities and the limitations which are reached in the direction of maximum compression of fibres. The problem is complicated by other considerations; as, for instance, when the wood has been compressed a certain amount it begins to split and relieves the pressure; furthermore, some destruction of the fibres will attend the driving of the nail, and it becomes a difficult question to decide just how much can be permitted in order to obtain the best results. The highest resistance will, of course, be reached when the fibres are compressed with the maximum pressure and their condition is such as to give the highest coefficient of friction between the surfaces of the nail and the wood, but it may be impracticable to arrive at the maximum values of these two conditions at the same time.

Wood tested in other directions, such as compression and transverse tests, show that a gradual yielding takes place under the action of a constant load much below that required to produce immediate rupture. Such action as this would cause a reduction in adhesive resistance after a nail had been driven some time, and, if the common impression is correct that old nails hold better than newly-driven ones, it must be due to an increase in the coefficient of friction from rust or other causes and not to an increase of pressure; that is, in case the wood was well seasoned at the start.

The compression from the tapering form of a nail extends in its effects a considerable distance into the wood, hence, to secure good results, it should not be driven close to the edge of the stick or in the vicinity of checks, as in either case there would not be sufficient supporting material.

The efficiency of sidewise compression of the fibres seems to be greater than endwise compression; that is to say, when a nail is driven perpendicular to the grain of the wood, the adhesive resistance is greater for the two faces which are parallel with than for those two faces which are at right angles to the grain. This is shown by driving a nail having the taper parallel with the grain, as nails are commonly driven, and driving another having the taper at right angles to the grain; the second nail will have the higher adhesive resistance; that is, when the taper acts against the fibres sidewise. The continuity of the endwise fibres are broken while the sidewise fibres remain intact, and, when strained by the nail there is advantage gained from the tensile stress which is brought into action as well as the direct compression.

Up to this time we have been considering the behavior of nails which were driven perpendicular to the grain, and have observed that compression of the fibres laterally, as represented by indentation tests, and compression endwise the grain, are elements of strength; also, that tensile stresses are brought into action in two directions; that is, parallel with the fibres and perpendicular to them, which is the stress that resists splitting along the grain.

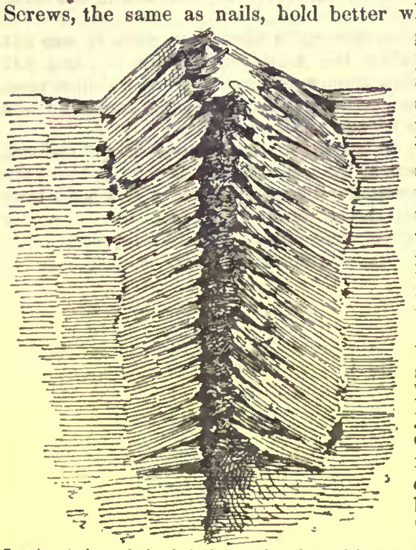
Inasmuch as the strength of wood in these several directions extends over a great range — or from 1,000 pounds per square inch, which produces a decided indentation of soft wood, up to 28,460 pounds per square inch, the tensile strength parallel to the fibres, which has been observed in a specimen of California laurel — it is obviously necessary to employ the wood in its strongest directions to obtain the best results. When nails are driven parallel to the grain — endwise the wood — there seems to be no option in the matter, placing the taper perpendicular or parallel to the rings of yearly growth, ordinarily producing too slight a difference to be certain of its identification. Exceptional cases would be found in woods which vary considerably in density at different parts of the yearly rings, and if very small nails were driven wholly in either the greater or the less dense sections. Nails parallel to the grain have adhesion due only to the indenting-strength and tensile strength of the wood perpendicular to the grain, directions, as we have seen, of inferior strength. If the wood splits, it has only to split in one direction longitudinally from the nail, and the most ordinary observation teaches that woods split most readily when started at the end of the fibres.

These reasons are thought sufficient to explain why nails exhibit less adhesion when driven parallel instead of perpendicular to the grain, as there seems no occasion for believing the coefficient of friction differs materially in the two cases.

The resistance of screws in wood is not properly an adhesive resistance although, commonly referred to as such, the shearing, transverse and tensile strength of the timber are the principal resistances called into use.

In soft woods gimlet-pointed screws are usually required to form their own holes and when so doing compress the wood as well as cut a thread in it; it is doubtful, however, whether much useful effect results from this compression. Screws perpendicular to the grain frequently show the maximum resistance after they have been drawn several hundredths or even an eighth of an inch, differing in this

respect from nails which lose a large per cent of their resistance once they are started, it therefore seems that the effect of compression on the screw would be lost before the fibres were so much disturbed. Screws, the same as nails, hold better when perpendicular to the grain. When they are parallel to the grain it is almost a simple case of shearing the fibres, but if perpendicular to the grain the transverse and tensile strength of the wood have to be overcome. Such is the general statement of the subject: some data will now be presented from the Watertown Arsenal tests, Report of 1884.



Sectional view of the hole in a white-pine stick after drawing out a lag-screw, showing the injured fibres.

The tests were made with cut nails, wire nails, spikes, common screws and lag-screws in white pine, yellow pine, chestnut, white oak and laurel wood. The nails and screws were tested singly, also cleats held by two and four nails. The wood was seasoned with the exception of the chestnut which was unseasoned, and certain of the pine and oak sticks were water-soaked after the nails were driven. Unless otherwise started the cut nails and spikes were driven with the taper of their sides or points acting lengthwise the grain of the wood. Holes were bored for all screws equal to their diameter at the root of the thread or slightly smaller, except that wood-screws in soft wood formed their own holes. Few sticks were experimented upon, one object of the tests being to ascertain the comparative resistance of different sized nails and screws in the same sticks. The adhesive resistances are reduced by computation to pounds per square inch of surface in the wood, no account being taken of the surface of the points of the screws nor the tapering surfaces at the points of the spikes.

In the Government report are summarized the general averages of the results with each kind of nail and wood, as follows:—

TABLE I.

Kind of Wood.	Specific gravity.	Kind of Nail, Spike or Screw.	Average adhesive resistance per sq. in. of surface in wood.	
			Driven perpendicular to the grain.	Driven parallel to the grain.
			Pounds.	Pounds.
White pine, stick A	.4666	Cut nails,	451	
White pine, stick B	.4717	"	350	208
" "		" corners barbed,	370	166
" "		" taper crosswise the grain	460	
" "		Steel-wire nails,	167	126
" "		Common spikes, ½″ sq.,	224	70
" "		Railroad spikes, .59″ "	262	
" "		Wood-screws,	925	654
" "		⅜″ lag-screws,	970	
" "		½″ " 5 threads per in.,	880	
" "		½″ " 6 " "	857	
White pine, stick C	.3922	1″ " 4 " "	551	
Yellow pine, stick D	.7862	Cut nails,	661	530
" "		" corners barbed,	473	397
" "		" taper crosswise the grain	768	
" "		Steel-wire nails,	318	252
" "		Common spikes, ½″ sq.,	432	
" "		Wood-screws,	1,493	1,213
" "		1″ lag-screws,	933	
Yellow pine, stick E	.6428	Common spikes, ½″ sq.,	629	
" "		1″ lag-screws,	991	
White oak, stick F..	.7603	Cut nails,	1,195	1,070
" "		" corners barbed,	846	766
" "		" taper crosswise the grain	1,158	
" "		Steel-wire nails,	940	802
" "		Common spikes, ½″ sq.	764	
" "		1″ lag-screws,	1,171	
White oak, plank G	.8240	Wood-screws,	2,598	
Chestnut		Cut nails,	683	
"		" corners barbed,	618	
"		" taper crosswise the grain	735	
"		Common spikes, ½″ sq.,	720	
California laurel....	.7190	Cut nails,	1,179	651
"		Steel-wire nails,	911	548
"		Wood-screws,	2,338	

From the data in Table 1 the actual resistance for a given case may be readily ascertained by first finding the surface in the wood and multiplying by the proper coefficient.

In Table 2 are given the actual resistances of several sizes of nails and screws taken from the details of the experiments. These figures would be found upon comparison to differ somewhat from those which might be deduced from Table 1, on account of the former table including a larger number of tests.

The results stated in Table 1, afford the means of ready comparison of the adhesive resistance of different nails and screws in the kinds of wood here represented.

TABLE II.

Kind of Wood.	Kind of Nail, Spike or Screw.	Size.	Length driven.	Total adhesive resistance.	
				Driven perpendicular to the grain.	Driven parallel to the grain.
			In.	lbs.	lbs.
White pine, stick B	Cut nails,	50d	3.00	915	506
" "	"	50d	4.00	1,305	693
" "	"	60d	3.00	976	458
" "	"	60d	4.00	1,292	842
" "	" corners barbed,	60d	4.00	1,456	631
" "	" taper crosswise the grain	60d	4.00	1,749	
" "	3″ steel-wire nails,	″.148	2.00	139	105
" "	Common spikes,	″.50	4.00	1,456	453
" "	2″ wood-screws,	12	1.25	776	496
" "	" "	14	1.25	799	421
" "	" "	16	1.25	877	553
" "	" "	18	1.25	930	797
" "	3″ "	18	1.85	1,410	1,079
" "	3½″ "	18	2.10	1,703	1,294
" "	½″ lag-screws,		5.00	6,155	
White pine, stick C	1″ "		5.00	7,777	
Yellow pine, stick D	Cut nails,	8d	1.50	490	414
" "	"	20d	2.50	1,016	943
" "	"	50d	3.00	1,574	1,301
" "	"	60d	4.00	2,508	1,812
" "	" taper crosswise the grain	60d	4.00	2,918	
" "	" corners barbed,	60d	4.00	1,796	1,507
" "	3″ steel-wire nails,	″.148	2.00	264	209
" "	Common spikes,	″.50	4.00	2,806	
" "	2″ wood-screws,	12	1.25	1,322	1,037
" "	" "	14	1.25	1,364	929
" "	" "	16	1.25	1,495	1,235
" "	" "	18	1.25	1,635	1,395
" "	3″ "	18	1.85	2,308	
" "	3½″ "	18	2.10	2,488	1,951
" "	1″ lag-screws,		5.00	12,777	
Yellow pine, stick E	" "		6.50	19,955	
" "	" lag-screws,[1]		8.00	17,990	
White oak, stick F	Cut nails,	8d	1.50	945	780
" "	"	20d	2.60	2,003	1,731
" "	"	50d	3.00	2,976	2,462
" "	"	60d	3.00	2,843	2,848
" "	" corners barbed,	60d	3.00	2,361	2,138
" "	" taper crosswise the grain	60d	3.00	3,230	
" "	3″ steel-wire nails,	″.148	2.00	780	666
" "	Common spikes,	″.50	4.00	4,967	
" "	1″ lag-screws,		5.00	17,717	
White oak, stick G	2″ wood-screws,[2]	12	1.25	1,963	
" "	" "	14	1.25	2,478	
" "	" "	16	1.25	2,439	
" "	" "	18	1.25	2,645	

[1] Length of thread, 6.50 inches. [2] Fractured screws at the root of threads.

The sides of the cut nails were tapered about five hundredths of an inch per inch of length, and as the distance they were driven in the wood ranged from one and one-half to four inches it will be seen that the wood was compressed by the sides of the nails, after the points had entered, from .075″ to .20″, which upon reference to the diagram of indentation tests corresponds to those parts of the curves in which there was considerable indentation without rapid increase of resistance. From this and other reasons mentioned in the general discussion of the behavior of the wood we probably have the explanation why different sized cut nails driven to different depths gave results nearly alike, or within the limits of variation expected of several nails of the same size in the same stick.

In white pine stick B the cut nails, driven perpendicular to the grain, taken in the order of their resistance from lowest to highest, are first those driven in the ordinary way with the taper acting lengthwise the grain, next those with barbed corners and then those driven with the taper crosswise the grain. Except in the white oak, nails with the taper crosswise the grain gave the highest results of their class. In the soft pine, barbing seems to be advantageous, in the chestnut the reverse is the case, and in the yellow pine and white oak barbing is decidedly disadvantageous. The results might and probably would be quite different were it not for the fact that the barbed nail cuts and destroys the fibres on its downward course, while being driven, and this action is relatively more serious in the hard than in the soft woods. If barbed nails could be got into the wood, as screws are driven, without such destruction to the fibres in that immediate vicinity higher results might be looked for, but as the case stands the objections to barbed nails in certain woods seem to be insuperable.



Magnified sectional view of the head of a cut nail showing the distortion of the fibres of the iron occasioned by upsetting during manufacture.

The steel-wire nails gave results below the cut nails; in fact, they displayed the least adhesive resistance of any of the material tested, with the single exception of the common spikes driven in white pine

parallel with the grain, which last tests are themselves exceptionally low, as will be seen when referring to the relative resistance of nails driven perpendicular to and parallel with the grain. Whereas with barbed nails we have extreme roughness and irregularity of surface; with steel-wire nails the opposite extreme is met, the surface of the nail being very smooth; furthermore, the best results are attained when the fibres are gradually compressed as done by tapering forms and not when the total amount of wood is abruptly displaced as done by the points of wire nails and spikes.

The flat point of a cut-nail would seem to be more injurious to the wood than the point of a wire nail, and such is doubtless the case, but the important difference consists in the after compression of the wood, on account of the tapering form of the cut nail, the stem of the wire nail being of uniform diameter throughout. The same criticism applies to spikes with parallel sides with this further disadvantage, that they displace an excessive amount of wood and thus weaken the adjacent fibres. When large spikes are used a hole bored, under size to receive them, would materially assist and relieve a part of the above objectionable feature.

The highest resistances are displayed by the screws, the average results obtained with wood-screws in the white-oak plank G reaching 2,598 pounds per square inch. When so high a resistance as this is reached, it is readily understood that danger arises of pulling the screw apart by exceeding the tensile strength of the wire.

Such instances were met both with nails and screws in the hard woods. The resistance of lag-screws compares favorably with that of the wood-screws. The coarse pitch of the thread of the lag-screws may possibly account for the slight difference between the two kind of screws which is observed. Too fine a pitch of thread would not give the screws sufficient hold in the wood, while a very coarse pitch concentrates the compressive stress between the threads and the fibres on a smaller surface, and encourages crushing of the wood in detail in front of the thread.

The difference in resistance of the nails and screws in the two directions, perpendicular to and parallel with the grain, is conspicuous. The average results show the strength in the latter direction to be seventy per cent of the former.

In white oak the percentage rose to ninety, while common spikes in white pine gave the exceptionally low result of thirty-one per cent. If these spikes were not included, the general average would rise to seventy-four per cent, which is probably a more reliable figure.

Heretofore we have discussed average results, the mean of several experiments of the same size nail in the same stick is the recorded value for that item. These experiments, however, form no exception to the rule that more or less variation in strength may always be expected in timber tests. Thus, it has been found that in the compression tests of some small sticks eccentricity of loading, even to the concentration of the entire load on one edge of the specimen, failed to give direction to the deflection of the stick preceding the maximum load of rupture. In the present tests wide differences have been observed while experimenting upon the same stick. No reference is now intended to nails improperly driven with oblique hammer blows, or where the nail was close by a star-check or other seasoning crack, but to cases where the wood was apparently sound throughout.

In yellow pine, stick D, the nails which were driven in rows across the stick showed a decidedly greater resistance along one edge over the other, a difference which was also observed in the driving, and those which drove the hardest gave the highest adhesive resistance.

In driving nails oblique to the direction in which they will be pulled, some discretion has to be exercised. The experiments with single obliquely driven nails was not favorable to this manner of driving, the nails bent while they were being pulled, tore up the wood, and the friction against one face of the nail, the surface on the outside of the bend, must have been almost entirely released. Better results were obtained with oblique nails when used in cleats; here they showed greater resistance than nails perpendicular to the surface of the cleat, although in each case the resistance was below corresponding results with single nails.

Thus cleats nailed to white pine, stick B, gave resistances of 238 and 287 pounds per square inch, when the nails were driven perpendicular and oblique twenty degrees respectively. Cl ats on yellow pine, stick D, gave resistances of 436 and 499 pounds per square inch under the same conditions. The taper of the nails, 60d's were used driven 3″, was crosswise the grain of the sticks.

Some nails and spikes were driven in dry wood, and then the pieces exposed alternately to the tide-water and air, and thus intermittingly wet for a period of thirteen days, after which they were tested. The nails were not rusty when withdrawn, although the wood was apparently water-soaked as deep as the nails were driven. 60d nails were used, and spikes which were ½″ square by 8″ long, each were driven 4″ into the wood.

In white pine, stick B, the nails showed 199 pounds per square inch, the spikes 231 pounds per square inch resistance. In yellow pine, stick D, the nails gave 488 pounds per square inch, the spikes 296 pounds per square inch resistance. In white oak, stick F, the nails gave 786 pounds per square inch, the spikes 458 pounds per square inch resistance.

It will be seen that all of these results, with wet sticks, are below the corresponding resistances with dry wood.

A number of experiments were made on the resistance of driving 60d nails perpendicular to the grain. These tests were made by slowly driving the nails with hydraulic power, and noting the force required.

The maximum resistance to driving in white pine, stick B, was 391 pounds per square inch when the nails were driven 3″, and 397 pounds per square inch when they were driven 4″. In yellow pine, stick D, the resistances were 572 pounds per square inch, and 635 pounds per square inch for 3″ and 4″ depth of nail.

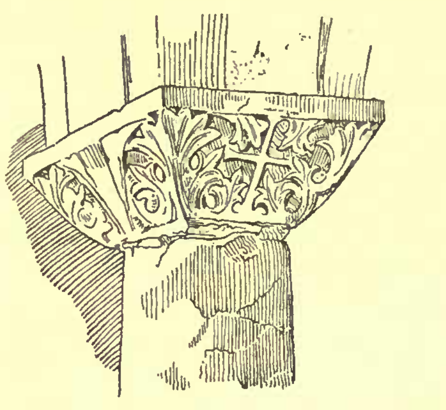
It was observed that the resistance to penetration was not uniform, but varied as different layers of the wood were reached; at times the nails would continue to penetrate the wood under a less load than had previously been resisted, this variation being from five to ten per cent of the load. These experiments were few, and as there were no observations on pulling the same nails a comparision of the resistances in the two directions cannot well be made, it is obvious, however, that the resistance to driving must be exceptionally low in the yellow pine.

The resistance to driving probably does not differ very much from the resistance to pulling, except so far as belongs to the displacement of fibres by the point of the nail which is encountered in the one case, but not the other, and the proportion which that resistance would bear to the whole should diminish as the nail is driven and the frictional surface in the wood increases.

The yielding of the fibres under high compressive loads has been referred to, and that behavior would cause somewhat greater resistance to driving than to pulling, provided some time elapsed between the two operations.

J. E. HOWARD.

LANDSCAPE GARDENING.—I.



CAPITAL, ST. ZENO, VERONA

After Drawing by R Barratt in The Architect

SEVENTEEN years ago, Mr. Frank J. Scott, — a pupil of our first American landscape gardener, Downing — published a volume called "*The Art of Beautifying Suburban Home Grounds.*" It was issued with the wish, not to instruct men of his own profession, but to aid amateurs, by verbal counsels and clear illustrations, to do their own work more sensibly and artistically than had previously been the rule. Yet, a professional man himself, Mr. Scott was far from thinking that amateur work was in itself desirable. He loses no possible chance of impressing upon his readers the fact that work with nature's materials, when it passes beyond the effort to grow and care for plants, and concerns itself with their arrangement out of doors, is artistic work, and, as such, can be thoroughly well managed by a well-trained artist only. And this fact he insists upon as almost equally true whether the laying out of large public parks or of small private grounds is in question. In either case, as he explains, what we should try is not merely to have pleasing things in view, but to combine them into a picture — pretty if the space be small, beautiful or majestic if its size be great. And to make a picture, great or small, pretty or imposing, needs the touch of an artist's hand. But he thought himself justified — and certainly was justified — in writing a book to aid the amateur. "It would be as absurd," he explains, "for the mass of men, engrossed in active business, to devote a large amount of time to the study of the mere rudiments of gardenesque art simply to enable them to lay out a half acre or acre of land, as for the business man to pore over an architect's library and pictures to enable him to design his own house — provided skilful planters were as easily found as competent architects. Twenty years ago there was the same dearth of architects of culture as there now is of educated gardeners. The general study of domestic architecture, which Downing's works then aided to make a fashion, produced, at first, an astonishing fermentation and rising of architectural crudities, but it also produced, afterwards, a crop of architects. If we can induce every family who has a home to adorn to study the art of planning and arranging their own grounds, the seed will be planted that will germinate, in another generation, in a crop of art-gardeners of such high culture and of such necessity to the educated community that it will be one of the honored professions of our best collegiates. Now, however, the number of such men, devoted to this profession, is so small that we have not heard even of more than half a dozen skilled professional gardeners among our thirty millions of native Americans, and of not greatly more than double that number of educated foreigners who have established a deserved fame among us as men of culture in their art. Even these men, with few exceptions, are little known outside the wealthy circles of the great cities, and not half appreciated where they are known. Until employers are themselves persons of culture, artists,

even when employed, are regarded as a kind of dilettanti whom it is necessary to employ rather to conform to the 'fashion' than for such service as the employer is competent to appreciate and really enjoy the results of. We know of nothing that will at the same time cultivate a taste for the fascinating art of gardenesque designing, and produce a quick return of pleasure for the time spent, as the study of paper plans for one's own grounds."

No words could be more sensible. Intelligent amateur work is certainly better than unintelligent, and the more intelligent the amateur worker becomes, the more certain he is to realize that only the artist can truly succeed in art, and the more able to appreciate true success when it is achieved. My main reason, however, for citing Mr. Scott's book and quoting his words is in order that we may consider a little the standing and prospects of the landscape artist at this present moment.

The advance made since the year when his book was published — 1870 — has not been remarkably great, either as regards the number of our artists or the public's appreciation of their services. Yet some advance in the latter direction has certainly taken place. An editorial article in the *Century Magazine* for June, 1887, calls attention to the fact and points to this profession as one in which there is certain soon to be a greater demand than supply unless a larger number of young men seriously train themselves for its practice than heretofore. And we shall be convinced that this is true if we look about us in our own home neighborhoods, if we talk with architects about their own and their clients' wishes, if we ask our leading landscape-gardeners whether or no the calls upon them have recently increased, and if we notice the newspaper reports of the manner in which large public undertakings are now being approached, even when works of architectural and not of gardening art are the main concern. The public seems to be awakening to the fact that gardening is an art and an important one, that, therefore, artists are needed, and that they should be so thoroughly trained and so well endowed as really to deserve the name. These are interesting facts, and I think they merit a little consideration in these columns, for no one can do more than the established architect to help on the progress of this nascent reform, and there is no place where recruits for the landscape-gardener's profession may more naturally be looked for than in the ranks of those who are thinking whether or no they will devote themselves to the sister profession of architecture. I need not insist upon the fact stated in the *Century* editorial that the architectural profession is becoming overcrowded. Surely the intrinsic attractions of the other are sufficient to draw men towards it if it offers them any fair chance of a successful and honored career.

To begin with, there is no profession whatsoever — unless it be that landscape-painter's — which suggests to the imagination so delightful an existence. It offers the chance of a life spent largely out of doors, in which the love of nature may be indulged, not as a casual refreshment, but as the very basis and inspiration of one's day's work. It involves the need for frequent travel and promises that broadening of mind which change of scene and contact with new groups of men supply. An art in itself, it works hand in hand with the art of architecture, and the landscape-gardener cannot but share the pride of the architect himself when the one has beautifully set and shown what the other has beautifully built. Broad as is the mental field which the architect may compass, the landscape-artist's is still broader, touching the domain of science on the one hand and that of idyllic poetry on the other. And so truly is his craft an art that there is no artistic quality which he may not express by its means. Form and color and composition are his materials as they are the painter's, and if he does not, like the figure-painter, represent human emotions, he does more than the landscape-painter who represents the things which excite these emotions — he, the creator of landscapes, actually creates these things.

I visited not long ago the home of a man who had devoted a great part of his life to the study of landscape arrangements. He thought he had devoted it simply to "the study of nature." Artists in paint were personally unknown to him, as were their professional theories, their systems and ideals, and their ways of looking at things in general. It was all the more interesting, therefore, to find how exactly his ways of thinking and looking, of theorizing and working were like theirs. Breadth, simplicity, appropriateness, concentration of interest, variety in unity — these were words perpetually in his mouth. The principles of composition — in perspective, in color, in lights and darks, and in light and shadow — upon which he had worked were precisely the same as those upon which a good landscape-painter works; and he had just as keen a sense of the general impression he wished to produce — the sentiment he wished to convey — as any other artist. His flowers were placed not where they would look well seen only close at hand, but where they would "tell" well in the landscape picture as a whole. Every foot of ground which was reflected in his little lake was planted not for itself only, but for the lake's reflections also — even a group of great poppies, high up on the bank, having been set there that a red stain might show in the water below the yellow stains caused by great clusters of hardy azaleas. And he took as much pleasure in finding that the sky-line of his trees was beautiful against a night sky, and that their masses were beautiful under the rays of the setting sun as though his work had been carefully done on canvas. I am not sure how many of his visitors appreciated the pictures he has thus created, and he himself was surprised at the suggestion that not "the lover of nature" but the lover of art would be likely to appreciate them most. But these pictures are works of art just as truly and in just the same sense as any ever done with paint.

It is not a love for nature which gives the power to work like this. The possibility of attaining such power largely depends, of course, upon a love for that which is most beautiful in nature. But this is a strictly artistic quality. It is not the same as that love for beauties of detail which makes a man a horticulturist, nor, on the other hand, the same as that interest in nature's ways of working which makes one a scientific botanist. It is just the same in essence as that which makes one a landscape-painter, though, of course, it needs a more extended and scientific kind of knowledge for its right expression. The landscape-gardener's is, in no sense, imitative work. He sets before himself ideals nowhere perfectly realized in nature. He takes her materials to work with, but some of them he sometimes alters and all of them he strives to bring to an individual perfection, which he rarely achives. And with these materials he usually combines the architect's and the engineer's. Sometimes he takes her suggestions with regard to general effect, but often he suggests to himself as desirable effects, which, strictly speaking, are non-natural. As a consequence the result sometimes though by no means always looks as though it were a spontaneous result of nature's efforts; but it invariably is the result of a man's imagination — the expression of a man's idea with regard to how a given spot might be made more beautiful than nature had made it or could have made it.

Too little of this is understood as yet by the public. It thinks of the landscape-gardener chiefly as one who attends to matters of detail — to choosing trees individually fine, plants individually pretty, and setting them where they will be individually effective, — and as one who in large pieces of work is a clever engineer, able to lay out convenient places for popular recreation and promenade. It does not see him as an artist concerned as all artists of all sorts are, first of all with his general effects — with the production of beautiful natural scenes, greater or smaller in extent, and, very often, with the adaptation of architectural works to their surroundings. Part of its dulness is due, perhaps, to the unfortunate ambiguity of the terms by which the art and its practitioners are characterized. When the art first emancipated itself from the trammels of conventionality in England and began to try to reproduce more nearly the effects of nature when at her best, its professors thought needful to apologize for their seeming conceit in calling themselves "landscape-gardeners." To-day, this term has become so degraded, they think, by popular misconception, that they prefer to call themselves "landscape-architects," getting the title from the French title *architecte paysagiste*. That is, in the last century it seemed over-ambitious for a man to talk of designing a "landscape." But to-day we have become so familiar with the effort and yet have grown so to confound a "landscape" with a "garden," that a still more ambitious and much less exact epithet is thought desirable to accentuate the difference between the mere gardener's and the true artist's work. Surely the older and exacter term is dignified enough in itself, and surely we should learn to recognize all that it really implies. And we are gradually getting to recognize it a little better. The intending professor of the art may, I think, be sure that he must make himself an artist in landscape if he hopes to succeed in his profession fifteen or twenty years from now. The reform which has overtaken architecture in America is evidently on its way in this sister path. The day is not far distant when we shall no more confound a landscape-gardener with a mere grower of plants, than we now confound an architect with a builder or with the carpenter who can construct pretty rustic seats and arbors.

To become an artist in landscape, therefore, the first thing needful is to study *art* in the broad and fundamental meaning of the word — to study its principles as that gentleman (unconsciously) had studied them to whose work I referred above. In his case it had been accomplished simply by studying nature very widely, attentively and sympathetically for the best that she can do, and the way she does it; and, of course, by studying the concrete results of other artists in the same path as his own. And I may add that I believe both Mr. Downing and Mr. Olmsted, the two most successful landscape-gardeners we have had in America educated themselves in a similar way. Nevertheless, it is not the way to be recommended. It takes far too much time, wastes far too much effort, and pre-supposes a keenness of insight and a justness of instinct which must surely be exceptional. The quicker and more certain way — the only way to be recommended to a young man whose living depends upon speedy and thorough acquirement — is to begin by studying art as art. To learn what good color means and good composition, what breadth means and good *chiaroscuro*, and variety in unity and the harmonious placing of effective accents, one may first go to those artists, who, themselves students of nature, have codified upon canvas so much that is finest in her suggestions. All good pictures teach these things, whether they be pictures of scenery or not. A similar course of pictorial study to that pursued by intending painters is one which would vastly benefit the intending landscape-gardener; and a similar course of theoretic reading also. Nor would the observation of works of sculpture come amiss — there is nothing which more quickly trains the eye, and to train his eye to the utmost sensitiveness to forms as well as to colors and masses of light and shadow is what the landscape-gardener needs. But, of course, the works of the landscape-painter are those which will help him most. These he should

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FUEL CARTRIDGES.

Several suits, in which prominent men of this city will figure, will soon furnish comment to the public, says the Troy *Press*. The securing of a patent on a Fuel Bomb by the Troy Globe Ventilator Company will be the cause of the suits. On April 30, 1872, David W. Thompson, who then resided at St. Joseph, Missouri, invented what is known as a "Fuel or Earth Cartridge." Mr. Thompson obtained United States letters patent, the claim of which was: "A fire-kindler consisting essentially, of a perforated metal case and a porous absorbent filling." In the second claim the article reads: "A handle combined with, and secured within the case." The Fuel Bomb is simple in construction, consisting of a shell of 4 x 5 inches, having metal edges and a wire gauze body. Mineral wool is placed in the shell, and saturated with kerosene, and then the affair is placed in the stove for use. The shell is very handy, throws considerable heat, and is considered by many far more convenient for household purposes than the oil-stove. Mr. Thompson also patented, July 2, 1872, a can for holding and filling the shell with kerosene or other combustible fluids. On or about the 1st of July, 1887, a cartridge which was termed an "indestructable fuel cartridge" was placed on the market by the "Coupon Introduction Company," at Nos. 39 and 41 Cortland Street, New York City. The sale of the article up to the 2d of August, according to the company's advertisement in the New York *World* of August 7, 1887, was upwards of 211,000. The Coupon Company did not possess a patent, but they sold the goods, which were marked "patent pending." The Company had applied for a patent, but it is understood that a patent was disallowed. The Coupon Company was aware of Mr. Thompson's patent on the shell and endeavored to trace the patentee. But the Company failed in their search, Mr. Thompson having moved from St. Joseph some thirteen years ago. The banks, postmasters and mercantile agencies were unable to tell where Mr. Thompson resided. The Company was in a quandary, and all search for the patentee thereafter was futile. The Globe Ventilator Company of this city, with commendable enterprise, about a month ago conceived the idea of manufacturing a fuel bomb. The Company came across Thompson's patent. A search for Thompson was instituted, and A. J. Farley, the travelling agent of the Company, set out from Troy about the latter part of last month to look up the inventor of the bomb. Mr. Farley travelled some 8,000 or 10,000 miles before he discovered that Mr. Thompson had moved to Englewood, Ill., one of Chicago's suburbs. Mr. Farley found Mrs. Thompson at her home, where he also found one of the original fire-kindlers which had been made by Thompson thirteen years ago. Mrs. Thompson informed the agent that her husband was now travelling for Emerson & Co., shoe manufacturers of Haverhill, Mass., of which firm Mr. Thompson is one of the members. Mrs. Thompson did not know of her husband's exact whereabouts, but he was expected in Buffalo, N. Y., within a few days. Mr. Farley at once retraced his steps to Buffalo, and eventually found the object of his search.

Mr. Thompson was already cognizant of the great sale which his article had attained. He asked Mr. Farley for a much larger price to relinquish his claim than the Globe Ventilator Company were willing to give. Mr. Thompson was at last brought to name a special figure, which was agreeable to the Company. The patents and all "chose in action" in every back claim were assigned to the Troy Company. The Globe Ventilator Company has now commenced suit against George S. Geer of this city and the Fuel Cartridge Company of New York City, in which $200,000 damages is claimed for infringement on the Company's patent. A suit will also immediately be begun aga nst the Earth Fuel Company of No. 2 Platt Street, New York, for a royalty on the goods they have manufactured. All other infringements will at once be prosecuted. Torrance & Company and Hoyt & Wynkoop, both firms of this city, who have been making castings, and J. B. Maltby, also of Troy, who has been furnishing wire cloth for the manufacture of the cartridges, and all others who have been furnishing any material for Mr. Geer for the manufacture of these goods have been informed that they must stop doing the same. The Globe Ventilator Company are now manufacturing the article under the name of "Imperishable Fuel Bomb." The Company will this week commence supplying the trade. It was this article with which Mr. Geer some time ago created a sensation in New York police circles by having one of the bombs placed in Inspector's Byrne's quarters, and when found it was thought an attempt had been made to take his life.

GLOBE VENTILATOR CO.,
TROY, N. Y.

DEFYING THE FIRE.

People passing the Terrace near Police Headquarters during the past two weeks, says the Buffalo *Express*, of August 17, have wondered what a little square brick building about ten feet wide and ten feet high stood out in the street for. The mystery was solved yesterday afternoon when a crowd gathered about the little structure at a respectable distance away from it. A blazing fire was raging on the ground within, and, as a small boy said, the experiment, for such it proved to be, would have been a very nice one to try in winter.

A test was being made of the fire-resisting qualities of the John A. Roebling's Sons Company fireproof patent stiffened wire-lathing. The wire cloth which constitutes this lathing was stretched across the planks at the ceiling of the temporary structure and two coats of mortar had been applied to it. A small portion of the bare brick wall near the ceiling was also coated with the lathing and mortar. Plenty of fuel was brought from a neighboring planing-mill, and for over an hour the little house was almost as hot as a smelting furnace. It was not long before the very walls began to crack and give way, and a bar of iron which formed the top of an opening near the floor was visibly bent. When the fire was extinguished examination showed that the test had been entirely satisfactory. Owing to the cracking of the side walls the mortar had fallen from them in places, but the ceiling was almost intact, the wire lathing not damaged in the least, and the wood above unharmed. The throwing of water upon the ceiling while yet hot had the effect, as was expected, of cracking the mortar, leaviug the lathing with one coat ready for another application.

An interested witness of the test was Mr. W. W. Carlin, the well-known architect, at whose instance it was made. He expressed himself as well satisfied. The wire lathing is manufactured by the New Jersey Wire-Cloth Company. John A. Roebling's Sons Company, the fame of whose name has been made world-wide by their connection with the great Brooklyn Bridge, are the agents. Mr. H. L. Shippy is the manager of the New York office at No. 117 Liberty Street. There are offices at Chicago, No. 217 Lake Street, and San Francisco, No. 14 Drumm Street; and Mr. R. T. Brown is the agent for the Company for Buffalo with headquarters in New York.

In this connection it may be well to recall an experiment with this wire cloth which, while successful, was not made by design. It happened several years ago at the Harvard Medical School, Boston. A fire occurred in one of the rooms, the walls of which were brick, with wooden joists, and the ceiling fitted with wire cloth, which kept the fire from

spreading after everything in the room was burnt out.

NEW JERSEY WIRE CLOTH CO.,
TRENTON, N. J.

NEW CATALOGUE.

MESSRS. EDWARD E. GOLD & COMPANY have just issued a new illustrated catalogue descriptive of their Compound Coil Heaters, patent steam trap, "Reliable" Water Feeder, etc. Of their Compound Coil Indirect Heaters they say: "The winding of coils, of number fourteen square wire, of strong elastic tension, around one-inch pipes of common return-bend coils (two pipes high), constitutes the main feature of this invention; while enclosing the same in substantial casings, lined with tin, which serve both for shipping and for the final adjustment of the stacks beneath hot-air pipes and registers, simplifies the almost endless details of steam or hot-water heating construction. This plan combines compactness, lightness, strength, rapidity of circulation, durability, and great economy of time and labor in erection. It adds to the advantages above enumerated great heating power, as it is impossible for a volume of air to pass through this heater stack without being completely and promptly warmed, as the main current is broken into innumerable smaller currents by means of the hot coils. These coils, by reason of their elastic force and spiral form, closely embrace and press the pipe at every point of contact therewith, thereby securing a great amount of extended heating surface of the most effective kind. Owing to this novel method of securing extended heating surface, the distance travelled by the steam or water, the number of joints and fittings, and the space occupied is less than one-quarter that of ordinary return-bend coils of equal heating power; hence the circulation is perfect, and freezing is wholly avoided.

Its weight is less than one-half that of cast-iron radiators, or ordinary box-coils; hence a great saving is effected in freight and cartage. Each stack, after having been tested to one hundred pounds to the square inch, hydraulic pressure, is then enclosed in a substantial casing of wood, lined with tin and ready for erection; thus saving the expense of carpenter, heavy hangers, bearers, etc., necessary in ordinary construction. These stacks are manufactured in various sizes, adapted for rooms of from five hundred to five thousand cubic feet capacity. The number of square feet is distinctly marked on each box, warranted to have a heating power equal to the same number of square feet made up of any indirect radiating surface in the market.

Testimonials from a few of the parties who are using the "Compound Coil Heaters":

[From J. Gould, Esq., 579 Fifth Avenue, New York.]

NEW YORK, January 6, 1885.

Messrs. Edward E. Gold & Co.:

Gentlemen, — The Low-Pressure Steam-Heating Apparatus you placed in my residence, cor. of Fifth Avenue and Forty-seventh Street in the fall of 1884, has given me entire satisfaction.

The great volume of pure fresh air, moderately heated, produced by your Compound Coil Heaters, give an agreeable temperature and perfect ventilation. I most cheerfully recommend the same. Very respectfully,
Jay Gould.

[From Hon. Russell Sage, 71 Broadway, New York.]

NEW YORK, January 11, 1886.

Messrs. Edward E. Gold & Co.:

The Steam-Heating Apparatus you put in my dwelling, No. 506 Fifth Avenue, as well as others in my dwellings on Madison Avenue, some three years ago, have given entire satisfaction. I can fairly add that they possess great heat-producing power and supply air of the best quality, for health, comfort, neatness, and economy.

I want to add a few words as to the working of one of your "Compound Coil Direct Heaters" attached to the steam apparatus in my office, No. 71 Broadway.

It has been in use about three years, and has proved all that could be desired in giving pure heated air, and enough of it to heat my office in the coldest of weather, and easily managed at all times. I consider it, as well as your dwelling heaters, among the very best heating apparatus in use at the present time, and as such I cheerfully recommend them. You are at liberty to refer to me any one in want of a heater, and also to give permission to examine the working of the heater, and see its completeness in working and its comeliness in appearance.

Respectfully yours, Russell Sage.

[From W. R. Vermiyle, Esq., Englewood, New Jersey.]

NEW YORK, March 29, 1882.

S. F. Gold, Esq.:

Dear Sir, — I have had considerable experience during the past fifteen years with Steam-Heating Apparatus (both cast and wrought iron), but have never had my house comfortably warmed until the introduction of your Compound Coil Radiators last fall. My house, which is about 50 x 50, is located in a most exposed situation, and the additions built upon it during the past year rendered it more difficult to heat than ever, yet we have gone through all the cold snaps without the least inconvenience. This I am convinced is due to your improved heating surface and admirable method of taking the air to be warmed *directly from out-of-doors*. So perfectly is this cold current warmed by your improved system that the air of the building is not affected by zero weather or Northwest gales.

Another excellent feature I have observed in your apparatus is the method of running the steam and return pipes so that frost cannot affect them. In short, I am so well pleased with your work that I do not hesitate to say that *I regard your system the perfection of artificial warming*. Very truly yours,
W. Romeyn Vermiyle.

[From J. A. Crouthers, M. E., No. 12 Cortlandt Street, New York.]

NEW YORK, January 5, 1886.

Messrs. E. E. Gold & Co.:

Gents., — Replying to your request I would say I am using one of your 78-foot Compound Coil Radiators to heat a room 18 x 36 x 12 with four large windows, using steam of from one to four pounds pressure, and find that with one register open I can maintain a temperature of 70° Fahr., and with both registers open the average temperature is too high for comfort. I am perfectly satisfied with its action and operation, although when I placed it I was of the opinion that it was no better, if so good, as a plain radiator, and I now intend to place some more of them in the same house.

Yours truly, J. A. Crouthers.

[From William A. Miles, Esq., Mt. Vernon, New York.]

NEW YORK, January 23, 1886.

Edward E. Gold & Co.:

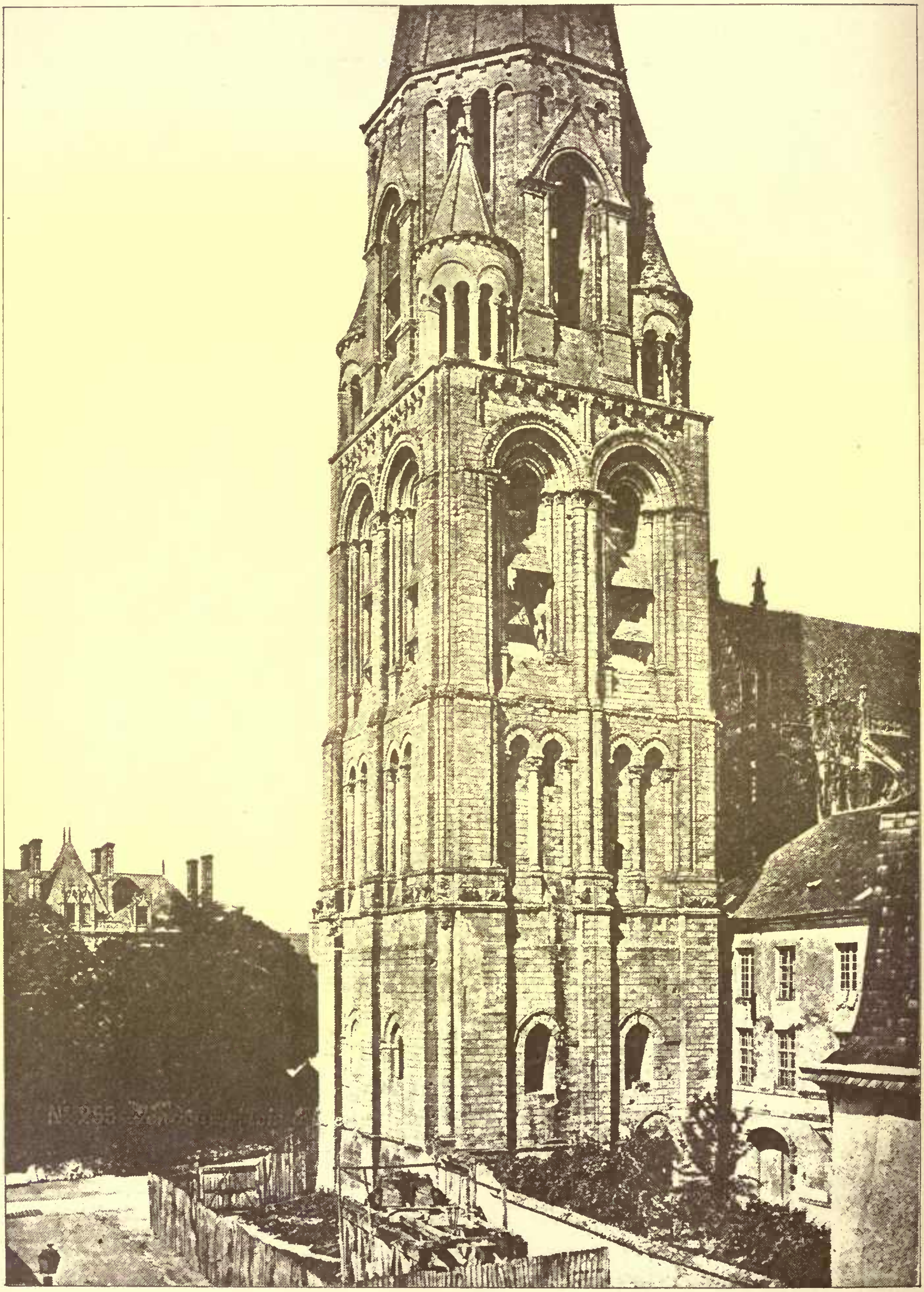
Gentlemen, — The Steam-Heating Apparatus erected by you in my residence at Chester Hill, Mount Vernon, for heating by indirect radiation, with your Compound Coil Heaters, has given us entire satisfaction. If I were building again I should not think of adopting any other system of heating. I remain, yours truly,
W. A. Miles.

[From Donald Mackay, Late President of the New York Stock Exchange.]

NEW YORK, March 24, 1882.

Samuel F. Gold, Esq.:

Dear Sir, — As winter is about passed I deem it but a duty on my part to write you and tell you how much pleased I am with the working of the "Steam-Heating Apparatus" that you



Heliotype Printing Co.

Abbaye de la Trinité, Vendôme.

CHRIST CHURCH : TOWANDA : PA



Heliotype Printing Co Boston.

PIERCE & DOCKSTADER
ARCHITECTS : ELMIRA :
STATE OF NEW YORK :

SUMNER
BUFFALO

National Monuments:



·Albert,·Prince Consort·Edinburgh·Scotland·



·Frederick·Wil

·A·W



·Prince Eugene of Savoy·Vienna·Austria·

·Fernkorn·Sculptor·



·Charles Albert

·Turi

·Baron·Charles

TIGENOR & Cº



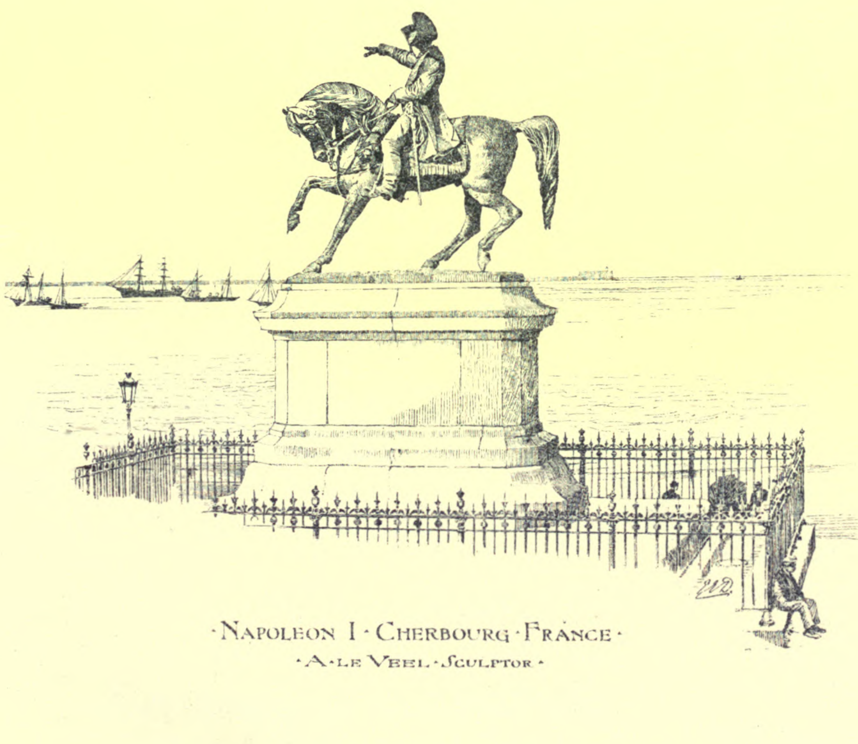
I· BERLIN · PRUSSIA ·
ULPTOR ·



· FREDERICK · THE · GREAT · BERLIN · PRUSSIA ·
· C · RAUCH · SCULPTOR ·



OF SARDINIA ·
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ETTI · SCULPTOR ·



· NAPOLEON I · CHERBOURG · FRANCE ·
· A · LE VEEL · SCULPTOR ·

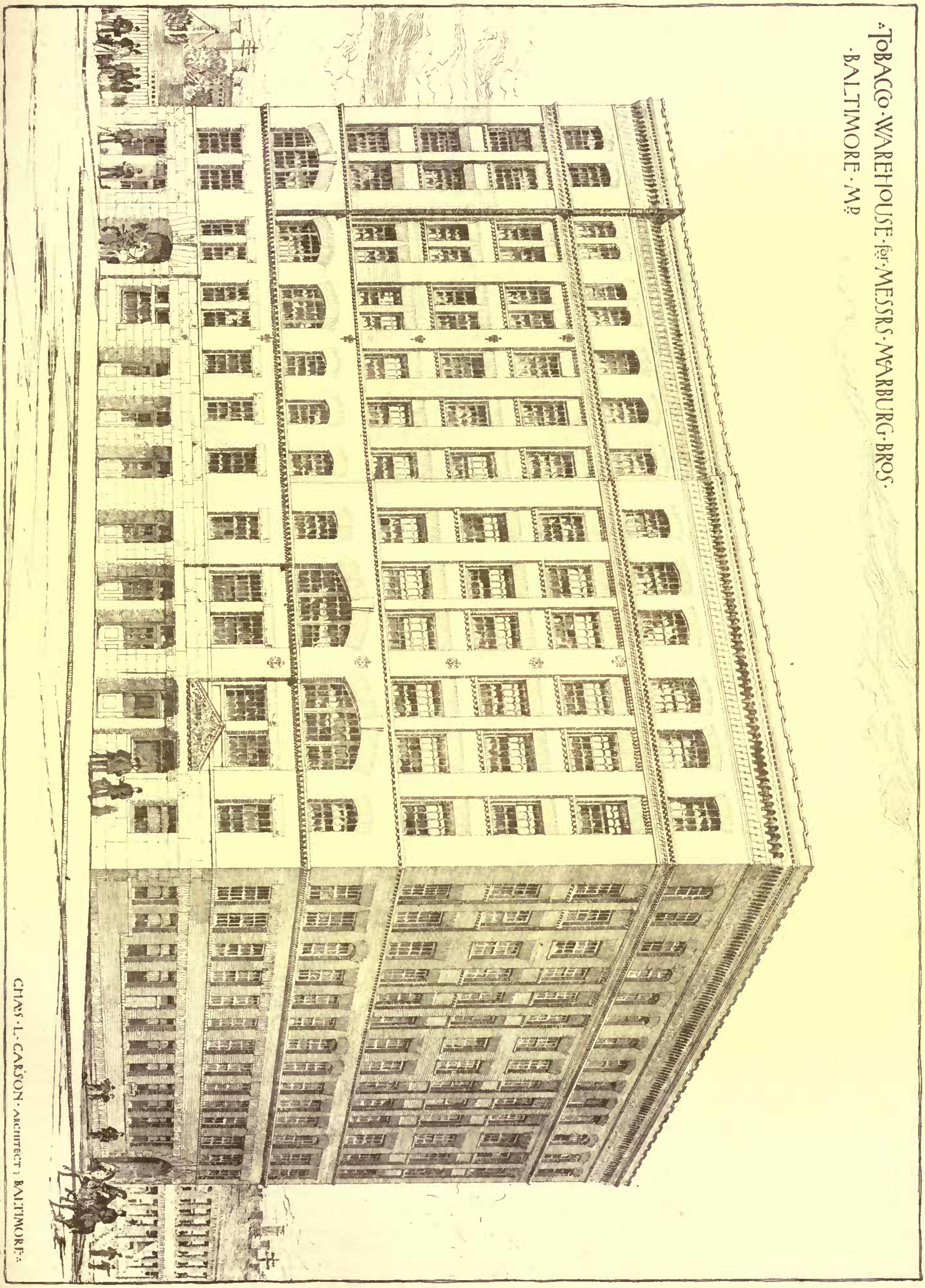
Heliotype Printing Co. Boston.



Heliotype Printing Co. Boston.

·Four·Houses ·in·West·55th St·N·Y·
·for·C·T·BARNEY·ESQ·

·JAS·BROWN·LORD·ARCHT·
·121·East·23rd·St·N·Y·



Heliotype Printing Co Boston.

put in for me during last summer. Of course you are well aware of the exposed situation of my house, and that I am not shielded from the weather from any quarter of the compass, and yet we have been able at all times to keep the whole house at a pleasant temperature, without driving the furnace at any time, and in most cases when there was but little or no wind, with the fire-door partially open. Another pleasure we have derived from the use of the steam heater is a perfect freedom from dust and the smell of coal gas. Having been so thoroughly satisfied with your heater, you may, if it be your wish, refer to me. Yours truly,

Donald Mackay.

[From W. G. Warden, Esq., President Atlantic Refining Co., Philadelphia, Pa.]

PHILADELPHIA, January 20, 1886.

Messrs. Edward E. Gold & Co.:

Gentlemen, — The Low-Pressure Steam-Heating Apparatus you made and placed in my dwelling-house on School Lane, Germantown has proven very satisfactory in every way. I have two boilers connected and find I can run one or both with perfect success. The steam fitting is first-class, and has not shown a sign of leakage or given me a particle of trouble. You will remember I put in a very large extra amount of your Coils and find in the coldest weather we have the benefit of having done so, and don't regret it. Yours respectfully,

W. G. Warden.

Architects, builders and contractors should send for this catalogue and read fully the comparative tests in indirect hot-water heating given at length therein — to

EDWARD E. GOLD & COMPANY,
CORNER OF FRANKFORT AND CLIFF STREETS, NEW YORK.

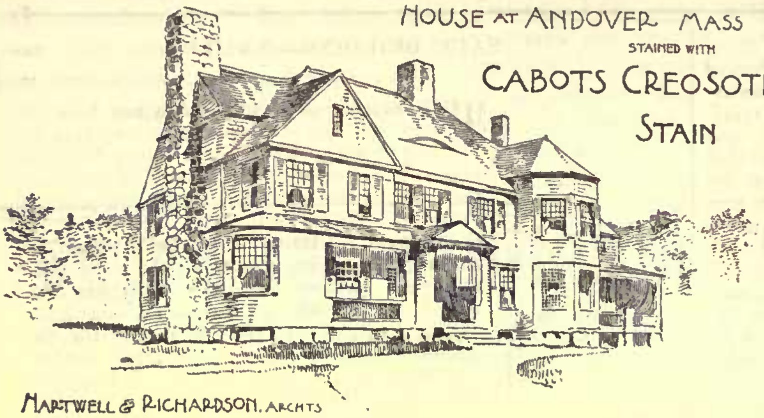
NOTES.

WE call the attention of architects and builders to the advertisement of the well-known firm of Hatten, Galpin & Company, the manufacturers of eight-foot seamless gutters and eave troughs. These gentlemen inform us that they are now prepared to furnish gutters in eight-foot lengths in any special styles from architect's designs — of copper, galvanized iron, IX choicest terne and tin. A few styles that they carry in stock (all eight-foot lengths) are shown in their advertisement elsewhere in this issue.

THE sales of boilers by the Babcock & Wilcox Co., for July and August, are as follows: Electric Club, New York City, 73 horse-power; Eagle Knitting Co., Elkhart, Ind., second order, 50 horse-power; Old Kentucky Woollen Mills, Louisville, Ky., second order, 104 horse-power; A. Hayward, San Mateo, Cal., 51 horse-power; Lehigh Coal and Navigation Co., Philadelphia, third order, 208 horse-power; Sibley Mills, Baltimore, Md., second order, 125 horse-power; Pacific Power Co., San Francisco, Cal., 208 horse-power; New York Steam Co., New York City, fourteenth order, 400 horse-power; New York Steam Co., New York City, fifteenth order, 250 horse-power; Edison Electric Illuminating Co. of New York, New York City, [thirty-fifth order for Edison Cos.] for three new stations, 8,700; Chicago, Burlington & Quincy R. R., Chicago, second order, 136 horse-power; St. Louis Refrigerator & Wooden Gutter Co., St. Louis, 240 horse-power; Chickies Iron Co., Chickies, Pa., 240 horse-power; Randleman M'f'g Co., Randleman, N. C., 51 horse-power; D. R. Campbell, Sangerville, Me., 122 horse-power; Interstate Consolidated Rapid Transit Railway Co., Kansas City, Mo., 400 horse-power; Peoples' Cable Railway, Kansas City, Mo., 600 horse-power; Troy Iron & Steel Co., Troy, N. Y., second order, 460 horse-power; Market St. Cable Railway, San Francisco, second order, 500 horse-power; T. A. Edison, (for new laboratory), Orange, N. J., 219 horse-power; New York Steam Co., New York City, sixteenth order, 250 horse-power, making a total of 13,387 horse-power.

Architects, Builders, and others will confer a favor on the Publishers by mentioning "The American Architect and Building News" when sending for circulars or corresponding with parties advertising in these columns.

CABOT'S CREOSOTE STAIN

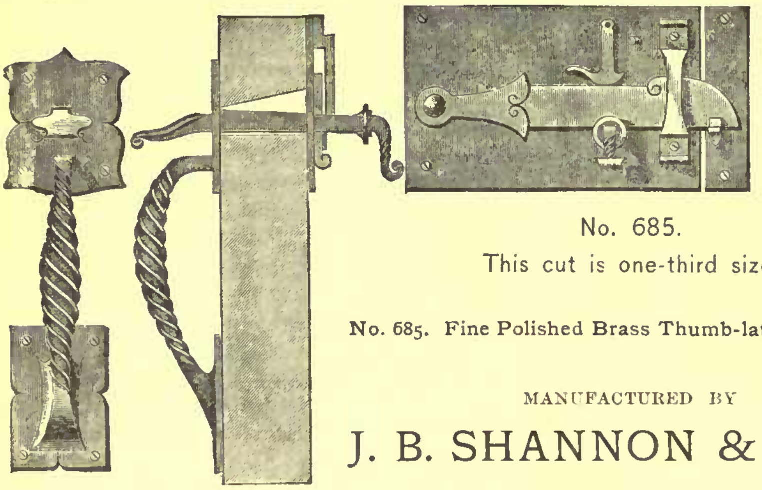


Is the only true exterior Stain made, all others are merely thin paints. Our stains have been in use since 1881, and have given excellent satisfaction, both as to durability and for the artistic effect they produce.

Send for Circulars and Samples.

SAMUEL CABOT, - - - - 70 Kilby St., Boston.

Fine Polished Brass Thumb-latch.



No. 685.
This cut is one-third size.

No. 685. Fine Polished Brass Thumb-latch, each, $4.00

MANUFACTURED BY

J. B. SHANNON & SONS,

No. 1020 Market Street, Philadelphia, Pa.



ESTERBROOK'S STEEL PENS



FOR SALE BY ALL STATIONERS.
THE ESTERBROOK STEEL PEN CO.
20 John Street, New York, N. Y.

To Architects and Builders.

Adopt MAHOGANY for interior finish; it is the handsomest and most durable cabinet wood known, and we are prepared to furnish it at prices that compare very favorably with those ruling for other hard-woods.

Correspondence solicited.

Wm. E. UPTEGROVE & BRO., Foot E. 10th & 11th Sts., NEW YORK.

study very carefully, on canvas when possible, and also in those print collections which reveal the conceptions of the great masters of oth.r times. In prints, by the way, though color is lacking, its very absence may be helpful by throwing other qualities into stronger relief.

It is needless to say that nature should be very carefully and lovingly studied, too. The learner cannot but recognize at once that in certain very important particulars his work differs from the painter's, and is vastly more difficult. He must compose, so to say, in the round. He must consider not one single point of view but many, and must find how he may best care for chief points of view without neglecting others. He must think, while composing and coloring, of the different illumination of different hours of the day, and must bear in mind the changes that will be wrought by successive seasons of the year and by successive years. He must paint for to-day but also for twenty years from to-day, and must remember that every hour of every day will give his picture a new aspect. And to learn how to do this he must study very sympathetically the changing world about him.

I do not know that a strong, youthful love for nature need be taken into account as essential to success in this profession. Such a love is a gradual growth of maturity quite as often — indeed, I think more often — than an inborn and early recognized gift. In any case it cannot better be cultivated than by learning to understand the work of nature's interpreters in art, while an eye trained upon their ideals and processes will best understand nature's practical suggestions and best put them to service in an allied art. However, it is needless to decide upon priorities in such a matter. Opportunities — the practical conditions of life — are sure to decide them in each individual case. The main thing is to keep one's eye and mind alert, and to study everything that can possibly cultivate eye and taste — not merely to look at good things and bad things with pleasure or distress, but to analyze their qualities and find out why they are pleasing or distressing. The main thing is to study both nature and art, and to study them together — so that each will explain and illustrate the beauties of the other.

Almost all writers on landscape-gardening, I may add, have strongly enforced the necessity for a training in taste other than that which the study of nature alone is likely in the majority of cases to supply. In nature the good and bad — or at least the good and less good — are too subtily intermingled for the average eye easily to distinguish between them. For this reason "the books" impress upon us the necessity of a study of painting, and none more insistently than those which represent that English generation when the art was at its best. The famous work of Sir Uvedale Price — "*A Treatise on the Picturesque*" — is a conspicuous case in point. And, to turn to the other end of the world, I may cite the feeling of the Japanese who, in certain directions at least and very likely in all, are the greatest landscape-gardeners whom the world has seen. I was talking with a Japane:e friend not long ago about the way their gardening work was done, and he said that while all their gardeners were professed artists, they by themselves managed small problems only. "When a large problem is in question," he explained, "anything like one of your public parks, the general scheme is always supplied by a *painter*." M. G. van Rensselaer.

[To be continued.]

The Illustrations

[*Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.*]

BAPTIST CHURCH, NEWTON, MASS. MR. H. H. RICHARDSON, ARCHITECT.

[Gelatine Print, issued only with the Imperial Edition.]

CHRIST CHURCH, TOWANDA, PA. MESSRS. PIERCE & DOCKSTADER, ARCHITECTS, ELMIRA, N. Y.

This church is to be built of native white conglomerate stone. The main contract is for $19,000, and the entire cost will probably be $22,000.

TOBACCO WAREHOUSE OF MARBURG BROS., BALTIMORE, MD. MR. CHARLES E. CARSON, ARCHITECT, BALTIMORE, MD.

NATIONAL MONUMENTS. IV. — EQUESTRIAN STATUES OF NAPOLEON I, CHERBOURG, FRANCE. A. LE VEEL, SCULPTOR; PRINCE EUGENE OF SAVOY, VIENNA, AUSTRIA. FERNKORN, SCULPTOR; THE PRINCE CONSORT, EDINBURGH, SCOTLAND. STEEL [?] SCULPTOR; FREDERICK THE GREAT, BERLIN, PRUSSIA. C. RAUCH, SCULPTOR; CHARLES ALBERT, KING OF SARDINIA, TURIN, ITALY. C. MAROCHETTI, SCULPTOR, AND FREDERICK WILLIAM III, BERLIN, PRUSSIA. A. WOLFF, SCULPTOR.

TOWER OF THE ABBAYE DE LA TRINITÉ, VENDOME, FRANCE.

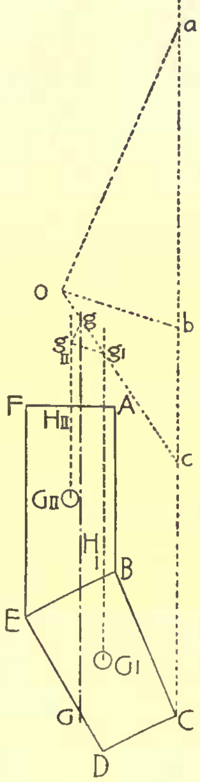
HOUSES FOR C. T. BARNEY, ESQ., NEW YORK, N. Y. MR. JAMES BROWN LORD, ARCHITECT, NEW YORK, N. Y.

SAFE BUILDING.—XVIII.[1]

ARCHES.

The manner of laying arches has been described in the previous chapter, while in the first chapter was given the theory for calculating their strength; all that will be necessary, therefore, in this chapter will be a few practical examples. Before giving these, however, it will be of great assistance if we first explain the method of obtaining *graphically* the neutral axis of several surfaces, for which the arithmetical method has already been given (Article I, No. 532).

Neutral axis found graphically. To find the vertical neutral axis of two plane surfaces A B E F and B C D E, proceed as follows: Find the centres of gravity G_{II} of the former surface and G_I of the latter surface. Through these centres draw G_{II} H_{II} and G_I H_I vertically.



Fig, 98.

Draw a vertical line *a c* anywhere, and make *ab* at any scale equal to surface A B E F, and at same scale make $b\ c$ = B C D E. From any point *o*, draw *o a*, *ob* and *oc*. From the point of intersection g_I of *o c* with H_I G_{I}, draw g_I g_{II} parallel *o b* till it intersects H_{II} G_{II} at g_{II}; from g_{II} draw g_{II} *g* parallel with *o a* till it intersects *o c* at *g*; through *g* draw *g* G vertically and this is the desired vertical neutral axis of the whole mass.

Where there are many parts the same method is used.

We will assume a segmental arch divided into five equal parts. Calling part A B C D = No. I; part D C E F = No. II, etc., and the vertical neutral axis of each part, No. I, No. II, etc.

Draw *a f* vertically and at any convenient scale, make

a b = No. I or A B C D
b c = No. II or D C E F,
c d = No. III or
d e = No. IV and
e f = No. V

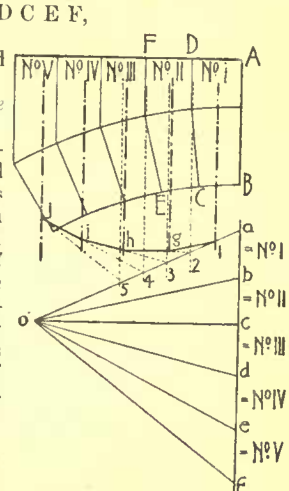


Fig. 99.

From any point *o* draw *oa*, *ob*, *oc*, *od*, *oe* and *of*.

From point of intersection 1 of vertical axis No. I and *oa*, draw 1 *g* parallel with *o b* till it intersects vertical axis No. II at *g*: then draw *g h* parallel with *o c* till it intersects vertical axis No. III at *h*; similarly draw *h i* parallel with *o d* to axis No. IV and *i j* parallel with *o e* to axis No. V, and, finally, draw *j* 5 parallel with *o f* till it intersects *a o* (or its prolongation) at 5. A vertical axis through 5 is the vertical neutral axis of the whole mass. Prolong *j i* till it intersects *o a* at 4, *i h* till it intersects *o a* at 3, and *h g* till it intersects *o a* at 2.

A vertical axis through 4 will then be the vertical neutral axis of the mass of Nos. I, II, III and IV; a vertical axis through 3 will be the vertical neutral axis of the mass of Nos. I, II and III; and through 2 the vertical neutral axis of the mass of Nos. I and II. Of course the axis through 1 is the vertical neutral axis of No. I.

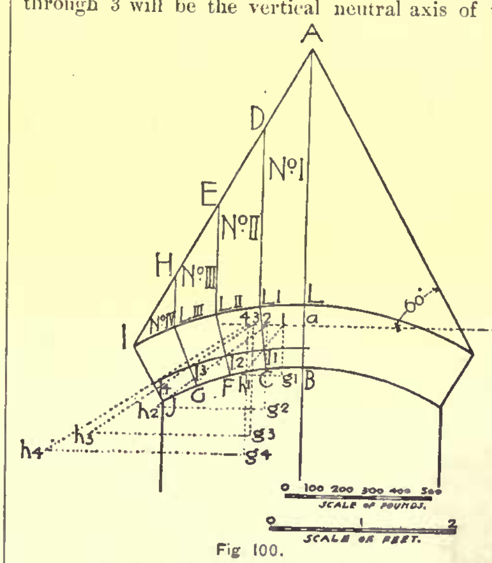


Fig 100.

We will now take a few practical examples.

Example I.

In a solid brick wall an opening 3 feet wide is bricked over with an 8-inch arch. Is this s.rong enough?[2]

The thickness of the wall or arch, of course, does not matter, *where the wall is solid*, and we need only assume the wall and arch to be one foot thick. If the wall were thicker, the arch would be correspondingly thicker and

[1] Continued from page 10, No. 601.
[2] For convenience, most of the figures are duplicated: the first, showing manner of obtaining the horizontal thrust; the second, the manner of obtaining the line of pressure.

Arch in solid wall. stronger, so that in all cases where a load is evenly distributed over an arch we will always consider both as one foot thick. If a wall is hollow, or there are uneven loads, we can either take the full actual thickness of the wall, or we can proportion to one foot of thickness of the arch its proportionate share of the load.

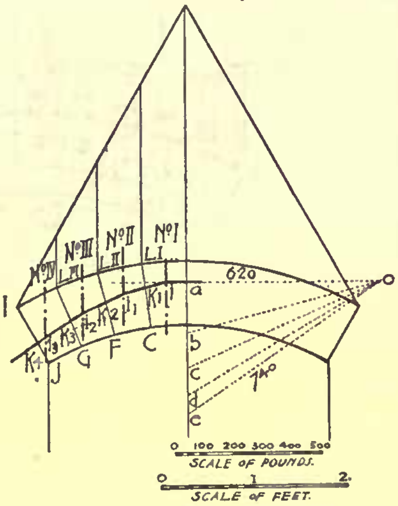


Fig. 101.

In our example we assume everything as one foot thick. The load coming on the half-arch B J I L Fig. 100, will be enclosed by the lines A L

Voussoirs arbitrary. and I A at 60° with the horizon. We divide the arch into, say, four equal voussoirs B C = C F = F G = G J. (The manner of dividing might, of course, have been arbitrary as well as equal, had we preferred.) Draw the radiating lines through C, F and G, and from their upper points draw the vertical lines to D, E and H. Now find the weight of each slice, *remembering* always to include the weight of the voussoir in each slice. We have, then, approximately,

No. I	(A B C D)	$= 3' \times \frac{1}{2}' \times 112$ pounds	$= 168$ pounds		
No. II	(D C F E)	$= 2\frac{1}{8}' \times \frac{1}{2}' \times 112$	"	$= 119$	"
No. III	(E F G H)	$= 1\frac{1}{2}' \times \frac{7}{16}' \times 112$	"	$= 73$	"
No. IV	(H G J I)	$= \frac{7}{8}' \times \frac{7}{16}' \times 112$	"	$= 43$	"
		Total		$= 403$	"

As the arch is evidently heavily loaded at the centre, we assume the point a at one-third the height of B L from the top, or

$$L\,a = \frac{LB}{3} = 2\frac{2}{3}''$$ and draw the horizontal line a 4.

As previously explained, find the neutral axes:

Horizontal pressures.
1 g_1 of part No. I,
2 g_2 of parts No. I plus No. II,
3 g_3 of parts Nos. I, II and III, and
4 g_4 of the whole half arch.

Now make at any scale 1 $g_1 = 168$ units $=$ No. I; similarly at same scale 2 $g_2 = 168 + 119$ units $= 287 =$ No I and No. II. and
3 $g_3 = 287 + 73$ units $= 360 =$ No. I + No. II + No. III.
4 $g_4 = 360 + 43$ units $= 403 =$ weight of half arch and its load.
Now make: C $l_1 = \frac{1}{2}$ C $L_1 = 2\frac{2}{3}''$.
Similarly, F $l_2 = \frac{1}{2}$ F $L_2 = 2\frac{2}{3}''$; also, G $l_3 = \frac{1}{2}$ G $L_3 = 2\frac{2}{3}''$,
And, J $l_4 = \frac{1}{2}$ J I $= 2\frac{2}{3}''$.

Through g_1, g_2, g_3 and g_4 draw horizontal lines, and draw the lines 1 l_1, 2 l_2, 3 l_3 and 4 l_4 till they intersect the horizontal lines at h_1, h_2, h_3 and h_4; then will $g_1\,h_1$ measured at same scale as 1 g_1 represent the horizontal thrust of A B C D; $g_2\,h_2$ the horizontal thrust of A B F E; $g_3\,h_3$ the horizontal thrust of A B G H and $g_4\,h_4$ the horizontal thrust of the half arch and its load. In this case it happens that the latter is the greatest, so that we select it as our horizontal pressure, and make (in Fig. 101) $a\,o = g_4\,h_4 = 620$ pounds, at any convenient scale.

Now (in Fig. 101) make $a\,b = 168$ pounds $=$ No. I.
$b\,c = 119$ " $=$ No. II.
$c\,d = 73$ " $=$ No. III.
$d\,e = 43$ " $=$ No. IV.

Draw ob, oc, od and oe.

Curve of pressure. Now begin at a, draw a 1 parallel with $o\,a$ till it intersects axis No. I at 1; from 1 draw 1 i_1 parallel with $o\,b$ till it intersects axis No. II at i_1; from i_1 draw $i_1\,i_2$ parallel with $o\,c$ till it intersects axis No. III at i_2; from i_2 draw $i_2\,i_3$ parallel with $o\,d$ till it intersects axis No. IV at i_3; from i_3 draw $i_3\,K_4$ parallel with $o\,e$. A curve through the points a, K_1, K_2, K_3 and K_4 (where the former lines intersect the voussoir joint lines) and tangent to the line a 1 $i_1\,i_2\,i_3$ K_4 would be the real curve of pressure. The amount of pressure on joint C L_1 would be concentrated at K_1 and would be equal to $o\,b$ (measured at same scale as $a\,b$, etc.). The pressure on joint F L_2 would be concentrated at K_2 and be equal to $o\,c$. The pressure on joints G L_3 would be concentrated at K_3 and equal to $o\,d$. The pressure on the skew-back joint J I would be concentrated at K_4 and be equal to $o\,e$. The latter joint evidently suffers the most, for not only has it got the greatest pressure to bear, but the curve of pressure is farther from the centre than at any other joint. We need calculate this joint only, therefore, for if it is safe, the others certainly are so,

Stress at extrados and intrados. too. By scale we find that J K_4 measures $2\frac{1}{4}''$, or K_4 is $(X =)\ 1\frac{1}{2}''$ from the centre of joint; we find further that $o\,e$ scales 740 units, therefore $(p =)\ o\,e =$ 740 pounds.

The width of joint is, of course, 8″, and the area $= 8 \times 12 = 96$ square inches; therefore, from Formula (44)

$$\text{Stress at edge J} = \frac{740}{96} + 6.\,\frac{740.\ 1\frac{1}{2}}{96.\ 8} = +\,16{,}26$$

and from (45)

$$\text{Stress at edge I} = \frac{740}{96} - 6.\,\frac{740.\ 1\frac{1}{2}}{96.\ 8} = -\,0{,}85$$

Or the edge J would be subject to the slight compression of $16\frac{1}{4}$ pounds, and edge at I to a tension of a little less than one pound per square inch. The arch, therefore, is more than safe.

Example II.

A four-inch rowlock brick arch is built between two iron beams, of five feet span, the radius of arch being five feet. The arch is loaded at the rate of 150 *pounds per square foot. Is it safe?*

In this case we will divide the top of arch A D into five equal sections and assume that each section carries 75 pounds — (which, of

Brick floor-arch. course, is not quite correct). We find the horizontal pressures (Fig. 102) $g_1 h_1$, $g_2 h_2$, etc., as before, and find

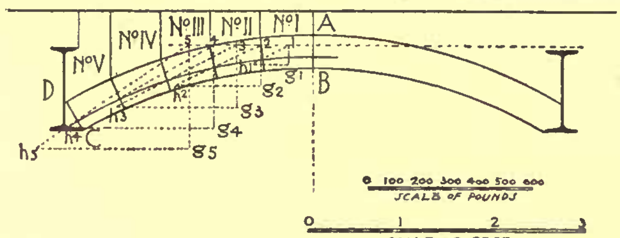


Fig. 102.

again $g_5\,h_5$ the largest and equal to 575 pounds. We now make (Fig. 103) at any convenient scale, $o\,a = g_5\,h_5 = 575$ pounds, and $a\,b = b\,c = c\,d = d\,e = e\,f = 75$ pounds and draw $o\,a$, $o\,b$, $o\,c$, etc. We now find the broken line a 1 $i_1\,i_2\,i_3\,i_4\,K_5$ where:

a 1 is parallel with $o\,a$	1 i_1 is parallel with $o\,b$
$i_1\,i_2$ " " $o\,c$	$i_2\,i_3$ " " $o\,d$
$i_3\,i_4$ " " $o\,e$	$i_4\,K_5$ " " $o\,f$

In this case again evidently the greatest stress is on the skew-back joint C D, for it not only has the greatest pressure $o\,f$, but the curve of

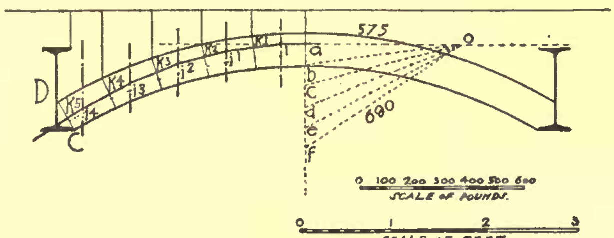


Fig. 103.

pressure passes farther from the centre than at any other joint. We find that C K_5 scales $1\frac{1}{4}$ inches, therefore the distance of K_5 from the centre is $(X =)\ \frac{3}{4}''$. We scale $o\,f$ and find it scales 690 units, or $(p =)$ 690 pounds. The joint is 4″ wide and its area $= 4 \times 12 = 48$ square inches.

From Formulæ (44) and (45) we have then:

$$\text{Stress at C} = \frac{690}{48.} + 6.\,\frac{690.\ \frac{3}{4}}{48.\ 4} = +\ 30{,}6 \text{ pounds and}$$

$$\text{Stress at D} = \frac{690}{48} - 6.\,\frac{690.\ \frac{3}{4}}{48.\ 4} = -\,1{,}8 \text{ pounds.}$$

The arch, therefore, is perfectly safe.

Glossary of Symbols. — The following letters, *in all cases*, will be found to express the same meaning, *unless distinctly otherwise stated*, viz.: —

a = *area*, in square inches.
b = *breadth*, in inches.
c = constant for *ultimate resistance to compression*, in pounds, per square inch.
d = *depth*, in inches.
e = coestant for *modulus of elasticity*, in pounds-inch, that is, pounds per square inch.
f = *factor-of-safety*.
g = constant for *ultimate resistance to shearing*, per square inch, across the grain.
g_1 = constant for *ultimate resistance to shearing*, per square inch, lengthwise of the grain.
h = *height*, in inches.
i = *moment of inertia*, in inches. [See Table I.]
k = *ultimate modulus of rupture*, in pounds, per square inch.
l = *length*, in inches.
m = *moment or bending moment*, in pounds-inch.
n = *constant* in Rankine's formula for compression of long pillars. [See Table I.]
o = the *centre*.
p = the *amount* of the *left-hand re-action* (or support) of beams, in pounds.
q = the *amount* of the *right-hand re-action* (or support) of beams, in pounds.
r = *moment of resistance*, in inches. [See Table I.]
s = *strain*, in pounds.
t = constant for *ultimate resistance to tension*, in pounds, per square inch.
u = *uniform load*, in pounds.
v = *stress*, in pounds.
w = *load at centre*, in pounds.
x, y and z signify *unknown quantities*, either in pounds or inches.
δ = *total deflection*, in inches.
ρ^2 = *square of the radius of gyration*, in inches. [See Table I.]
𝔡 = *diameter*, in inches.
𝔯 = *radius*, in inches.
π = 3.14159, or, say, 3.1-7 signifies the *ratio of the circumference and diameter of a circle*.

If there are more than one of each kind, the second, third, etc., are indicated with the Roman numerals, as, for instance, a, a_I, a_{II}, a_{III}, etc., or b, b_I, b_{II}, b_{III}, etc.

In taking moments, or bending moments, strains, stresses, etc., to signify at what point they are taken, the letter signifying that point is added, as, for instance: —

m = moment or bending moment at *centre*.
m_A = " " " *point A*.
m_B = " " " *point B*.
m_X = " " " *point X*.
s = strain at *centre*.
s_B = " *point B*.
s_X = " *point X*.
v = stress at *centre*.
v_D = " *point D*.
v_X = " *point X*.
w = load at *centre*.
w_A = " *point A*.

Example III.

Two iron beams, five feet apart, same as before, but filled with a straight 7″ hollow fire-clay arch. The load per foot to be assumed at 140 *pounds. Is the arch safe?*

Fireproof floor-arch. Of the 350 pounds on the half arch we will assume 80 pounds to come on each of the blocks and 30 pounds on the skew-back. We then (in Fig. 104) find, as before, the

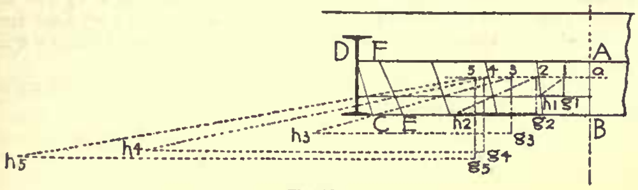


Fig. 104.

horizontal pressures, $g_1\,h_1$, $g_2\,h_2$, etc. Again we find the largest pressure to be $g_5\,h_5$, and as it scales 2040 units, we make (in Fig. 105) at

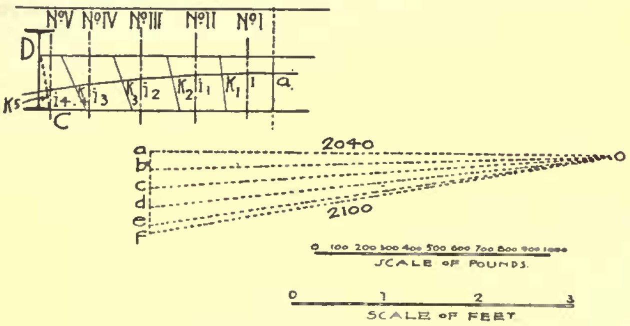


Fig. 105.

any convenient scale and place $o\,a = g_5\,h_5 = 2040$ pounds. We also make $a\,b = b\,c = c\,d = d\,e = 80$ units and $e\,f = 30$ units.

Draw *oa*, *ob*, *oc*, etc. Drawing the lines parallel thereto, beginning at *a* we get the line $a\;1\;i_1\;i_2\;i_3\;i_4\;K_5$, same as before. Imagining a joint at C D this would evidently be the joint with greatest stress, for the same reasons mentioned before. We find C K_5 scales $2\frac{5}{8}''$, and as C D scales $7\frac{1}{4}''$ the point K_5 is distant from the centre of joint.

$$(X =)\ 3\tfrac{5}{8} - 2\tfrac{5}{8} = 1''$$

as $o\,f$ scales 2100 units or pounds, and the joint is $7\frac{1}{4}''$ deep with area $= 7\frac{1}{4}.\ 12 = 87$ square inches, we have:

$$\text{Stress at C} = \frac{2100}{87} + 6.\,\frac{2100.\ 1}{87.\ 7\frac{1}{4}} = +\ 44{,}14 \text{ pounds and}$$

$$\text{Stress at D} = \frac{2100}{87} - 6.\,\frac{2100.\ 1}{87.\ 7\frac{1}{4}} = +\ 4{,}14 \text{ pounds.}$$

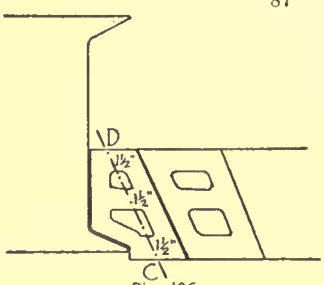


Fig. 106.

The a ch, therefore, would seem perfectly safe. But the blocks are not solid; let us assume a section through the skew-back joint C D to be as per Fig. 106. We should have in Formulæ (44) and (45) *x*, *p*, and the depth of joint same as before, but for the area we should use $a = 3.1\frac{1}{2}.12 = 54$ square inches, or only the area of solid parts of block. Therefore we should have:

$$\text{Stress at C} = \frac{2100}{54} + 6.\,\frac{2100.\ 1}{54.\ 7\frac{1}{4}} = +\ 71 \text{ pounds, and}$$

$$\text{Stress at D} = \frac{2100}{54} - 6.\,\frac{2100.\ 1}{54.\ 7\frac{1}{4}} = +\ 6{,}71 \text{ pounds.}$$

There need, therefore, be no doubt about the safety of the arch.

Example IV.

Over a 20-inch brick arch of 8 *feet clear span is a centre pier 16′ wide, carrying some two tons weight. On each side of pier is a window opening $2\frac{1}{2}$ feet wide, and beyond, piers similarly loaded. Is the arch safe?*

Arch in front wall concentrated loads. We divide the half arch into five equal voussoirs. The amounts and neutral axis of the different voussoirs, and loads coming over each, are indicated in circles and by arrows; thus, on the top voussoir E B (Fig. 107) we have a load of 2100 pounds, another of 62 pounds, and the weight of voussoirs or 228 pounds. The neutral axis of the three is the vertical through G_1 (Fig. 108). Again on voussoir E F (Fig. 107) we have the load 174 pounds, and weight of voussoir 228 pounds; the vertical neutral axis of the two being through G_{II} (Fig. 108). Similarly we get the neutral axis G_{III}, G_{IV} and G_V (Fig. 108) for each of the other voussoirs. Now remembering that $1\;g_1$ (Fig. 107) is the neutral axis of and equal to the voussoir B E and its load; $2\;g_2$ the neutral axis of and equal to the sum of the voussoirs B E and E F and their loads, etc., we find the horizontal thrusts $g_1\,h_1$, $g_2\,h_2$, $g_3\,h_3$, etc. The last $g_5\,h_5$ is again the largest, and we find it scales 7850 units or pounds.

The arch being heavily loaded we selected *a* at one-third from the top of A B. We now make (Fig. 108) $a\,o = 7850$ pounds or units

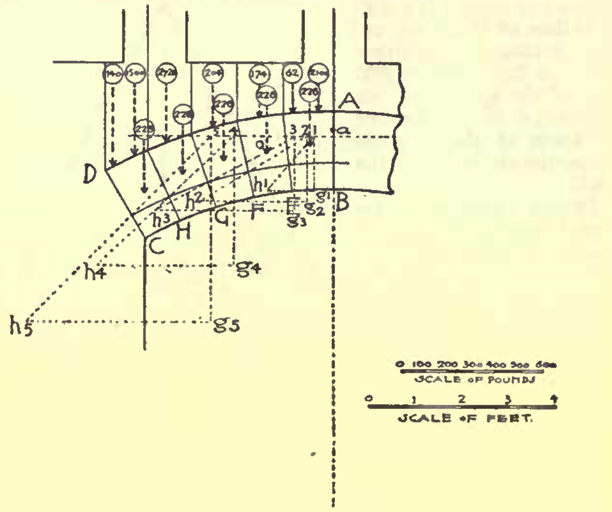


Fig. 107.

at any scale; and at same scale make $a\,b = 2390$ pounds; $b\,c = 402$ pounds; $c\,d = 432$ pounds; $d\,e = 2956$ pounds, and $e\,f = 1868$ pounds. Draw $o\,b$, $o\,c$, $o\,d$, etc. Now draw as before $a\;1$ parallel with $o\,a$ to axis G_1; also $1\;i_1$ parallel with $o\,b$ to axis G_{II}; $i_1\,i_2$ parallel with $o\,c$ to G_{III}, etc. We then again have the points a, K_1, K_2, K_3, K_4

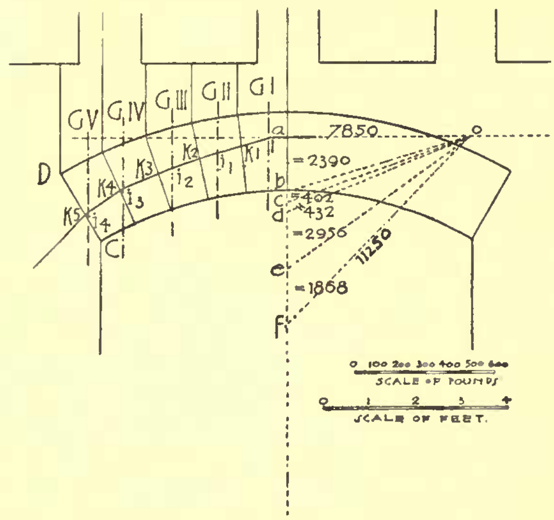


Fig. 108.

and K_5 of the curve of pressure. As K_5 is the point farthest from the centre of arch-ring and at the same time sustains the greatest pressure ($o\,f$) we need examine but the joint C D; for if this is safe so are the others. We insert, then, in Formulæ (44) and (45) for

$p = o\,f = 11250$ pounds, and as K_5 C measures $6\frac{1}{2}''$,
$x = 10'' - 6\frac{1}{2}'' = 3\frac{1}{2}''$; also as the joint is $20''$ wide,
$a = 12.\ 20 = 240$ square inches.

Therefore

$$\text{Stress at C} = \frac{11250}{240} + 6.\,\frac{11250.\ 3\frac{1}{2}}{240.\ 20} = +\ 96 \text{ pounds, and}$$

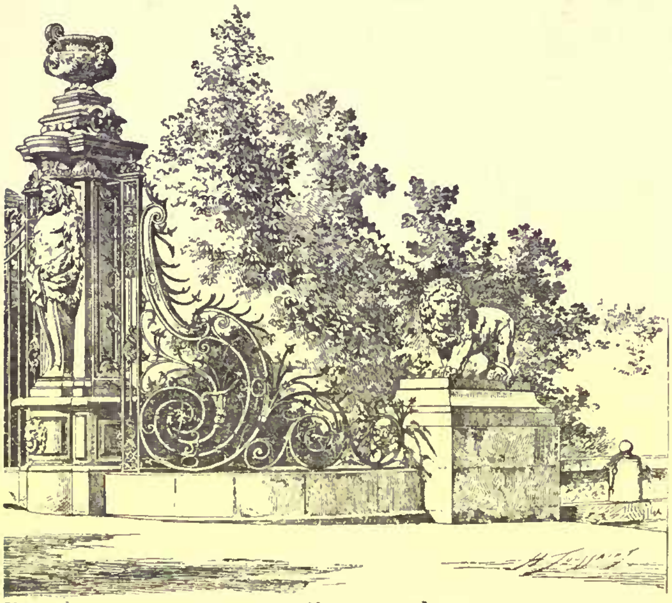
$$\text{Stress at D} = \frac{11250}{240} - 6.\,\frac{11250.\ 3\frac{1}{2}}{240.\ 20} = -\ 3 \text{ pounds.}$$

The arch is, therefore, safe. LOUIS DECOPPET BERG.

[To be continued.]

A ROMANCE IN OIL.—Mr. John McKeown, of Oil City, Penn., struck it rich. On the 22d of last June an oil well that he had been boring came in. It was a good well from the start. At first it yielded 80 barrels an hour. After producing at this rate a few days it was drilled deeper into the sand. A new "pay streak" was found and its production immediately increased to 140 barrels an hour. Since the 22d of June it has produced 145,000 barrels of oil, on which Mr. McKeown has realized 68 cents per barrel. He has no partners, and, owning the land in fee, has no royalty to pay. The entire output has been his own, and this amounted in the two months and four days to $98,600. The original cost of the well was about $4,000, and the expense of taking care of it since it was struck not over $500. This would leave Mr. McKeown a profit from this one well of $94,100. The well is still doing 50 barrels an hour, and experienced operators think it will turn out $150,000 worth of oil, even at the present low prices, which is why we remark that Mr. John McKeown struck it rich.—*Indianapolis Journal.*

A DAY IN MONTREAL.



FROM LA CONSTRUCTION MODERNE.

OF all the dreary places in this world to be detained in on a dull autumn day after an early frost has partly blighted the foliage and given it the dejected air of a recently-whipped chanticleer, and when the low clouds and the smoke from neighboring forest fires vie with one another in the processes of mystification, which add neither charm nor glamor to the objects they obscure — of all discouraging, disheartening places, there can be few to contest the palm with Montreal, metropolis of the Dominion of Canada and home of Canadian swelldom. Even on pleasant days it can hardly be an agreeable city to live in as to it is lost, through its position at the base of a low hill, one of the most unwearying of Nature's many charms, the beautiful changes that attend the slowly setting sun. To see the sun go abruptly out of sight behind the hill at the back of the city while it is still an hour high can hardly be compensated for by such reflected glories as the eastern clouds may yield. The view in front of the city is not fine enough to give excuse for placing the city on the lower level instead of on the hill itself. The choice of site seems to betoken the shop-keeping instinct of the citizens, and as the keeping of shops is the prerogative of the Englishman it is not surprising to find that the English element, social and commercial, overshadows whatever sprinkling of French sentiment and character may be found scattered through the town or in the distinctively French quarter.

Any one who visits Montreal expecting to encounter a flavor of a foreign country, a spice of things quaint and unaccustomed, will find himself grievously disappointed. He will not meet even a red coat out on leave in his shell jacket and ridiculous little fatigue cap held on an impossible spot on his head by a strap passed under his martial nose, for the English troops were withdrawn in 1870, and whatever defences there are are in the hands of the Canadian militia. An infrequent hansom-cab — which can be seen in New York, Boston or Newport, without crossing the line — is about all of a social kind that distinguishes the life here from that in any American city, if the occasional rencontre with a frocked priest of one kind or another is excepted, and, in some parts of the city, the presence of the *habitant* with his perfectly unintelligible jargon of Canadian French. English accent, English clothes, whiskers, eye-glasses met at every turn give evidence that the inhabitants, even if born on this side of the Atlantic, maintain relations with the mother country rather than with other parts of the Dominion.

The city is oppressively architectural. Hardly a building is to be seen that does not have the air of having been put into shape, with more or less success, on the drawing-board. The simple straightforward work of the work-a-day builder who contents himself with plain walls, simple roof and rectangular holes for doors and windows is conspicuous by its absence. Every building has to have as much elaboration of moulded and cut work about doors, windows and cornice as its owner's pocket will afford, and it becomes a weariness to the flesh and a vexation to the spirit to see the same things — or very nearly the same — repeated in one building after another, up one street and down the next. It is all very architectural, but it is very uninteresting, and makes one misdoubt the preëminence of the constructive art and of those who profess it. Now and then something is met which seems to have a local flavor, as a long wooden two-story block on a side street, with deep covered piazzas on both stories, and a projecting semi-circular pillared porch in the centre to give accent to the whole. But a wooden building is, in spite of wood being the staple Canadian product, a rarity in most parts of the city. Almost everything is built of the same lugubrious limestone, a dingy, slaty-colored substance, which is about as agreeable to the eye as would be a piece of frozen slush from a Pittsburgh street. Besides its initial gloom, it discolors in the same way as does the Portland stone in London's smoky atmosphere, and in the business parts of the town may be met buildings which would not look out of place amid the grime of St. Paul's Churchyard. It is a great pity it is so unpleasant a material to look at for it appears to be a most excellent building material, wearing well and of a close, fine texture that allows careful carving, so that the prevailing tendency to coarse mouldings and carvings appears to be inexcusable. To speak plainly the finish of most of the buildings appears to be made from stock patterns, so that if a moulding is to be used at all it must have members of precisely the same size as those above it or below it, or in the next street on a building of thrice the size. Until observation has convinced the wanderer that everything is really stone worked by hand, he stops frequently to satisfy himself whether the work is real stone or artificial stone cast in a mould.

Besides being so obnoxiously architectural, the city is overwhelmingly ecclesiastical. Churches meet you at every turn; sometimes you will find three out of the four corners at a street-crossing occupied by churches, all of about the same size, all of the same dismal stone, all costing apparently one as much as its neighbor, and each calling for about the same modicum of approbation from the visiting architect. One thing is very noticeable — they all seem to be complete entities; very few have the air of having reached the point where money gave out before the building was finished, as is so noticeably the case in some American cities — in Baltimore, for instance. The reason of this superabundance of vantage points for whipping the devil round the post is not far to seek: the population is a mixed one, and each race, out of sheer pride of race, perhaps, has to have a full and complete assortment of tabernacles. The Catholic element predominates, and French Canadian and Irish Canadian have to have their separate establishments, with their concomitant schools, seminaries, colleges, hospitals, orphanages and so on, with a proper force of priests, brothers, sisters, monks and nuns. The English element has its cathedral and high and low churches and its meeting-houses for the dissenters. The Scotch Established Church has to have an abiding-place and, also, various forms of Presbyterianism known in Great Britain. Besides these, all the different sects that are known in the States seem to be represented here in sooty limestone, and the peculiar architecture of the Jewish synagogue shows that the children of Israel have not been backward in providing themselves with a shelter within which they can celebrate the rites at which the outer Philistine is somewhat overprone to jeer. It would seem as though the citizens must take their pleasures sadly — except at carnival time — for placards advertising church fairs and festivals usurp on the poster-boards the places usually occupied by the announcements of the legitimate or the melo-drama. There must, of course, be theatres in a town of 180,000 inhabitants, but it was not easy to detect their whereabouts; attention is so forcibly abstracted from things secular that if, as they possibly are, they are concealed in the intestines of some block of miscellaneous structures, it is no wonder that their entrances escaped notice.

Of the really interesting buildings in the city, the one which seems to leave the most vivid impression on the memory is the Examining Warehouse, down on the levee opposite the landing of the ocean liners, which seem strangely out of place up here in the middle of Canada. The building is a rather low, irregular block of perfectly simple design, and gets its character from the three narrow, arched openings which rise nearly to the main cornice line and divide the façade into four bays. Down here, with the water near by and no foliage to throw it out of key, the limestone looks less mournful than in other parts of the city. An interesting piece of work is going on along the water-front just in front of it in the heightening of the stone embankment by a crown of wooden piling, bracing and sheathing which is designed to keep the river from overflowing its banks in the time of the spring floods, as it has hitherto had a habit of doing, the flood sometimes rising six or eight feet above the embankment and causing loss and discomfort in the buildings on the lower levels. All the sheds and warehouses on the levee have to be taken down and stored in safety when navigation closes for the winter.

The Bank of Montreal is, of course, known as an interesting building, but it is not an uncommon kind of structure, for Classic porticos as rich and pleasingly proportioned may be found in many places. There is, however, one portion of the façade worthy of note, a two-story addition at the left, the upper story treated as an attic and decorated with two or three large figures in very flat relief, which, so far as the foliage would allow them to be seen, seemed to be uncommonly graceful. It would be a benefit to this building, as it would be to most of the others in the city if the returning army of lumbermen could be turned loose in the streets next spring with instructions to thin out the trees everywhere by at least one-half. It is almost impossible to get an unobstructed view of a building except in the business streets, as the trees are everywhere obtrusive, and are most of them of just the age that you can neither see over them nor under them nor yet through them. What, when seen from a distance over housetops, seemed to be a very promising thirteenth-century French Gothic church, proved to be almost invisible from the streets it fronted so full was its yard with trees of forty or fifty years' growth; and in the residential quarters, the manner in which trees surrounded

and almost grew into the windows of the houses, suggested inmates of pallid complexion and anything but robust physique.

The next most impressive and interesting building is the great unfinished Church of St. Pierre, which is intended to be a reproduction, at a reduced scale, of St. Peter's at Rome. When first seen one is disposed to think that the game was hardly worth the candle, but the more often it catches the eye from one part of the city or another the more it gains in impressiveness. It is in a most interesting stage of construction, the shell of the building finished and the exterior in the main complete, the front portico and the pavilion domes only being lacking. But the interior is as yet untouched, though free from builders' scaffolding, and offers every chance for a study of the construction. As the wanderer passes in and out amongst the great piers and gazes up into the great brick-lined dome the regret is ever present that a grand opportunity for creating one of the most awe-awakening church interiors in the country is, in all probability, to be frittered away: that the simple masses of the constructive members, which have the grandeur that belongs to mass and simplicity, are to be concealed by an interior finish of woodwork which, after the Roman Catholic method, is to be maltreated with color decoration which rarely succeeds in being anything more than tawdry in its vulgar excess. Even the interior of the Cathedral of Nôtre Dame, not far away, which has the merit of being the largest in the country, looks loud and commonplace in spite of the fact that the decoration, which is quite new, was copied from that of the Sainte Chapelle at Paris. What is there rich and quiet and toned to harmony by the light through the stained window, is here unsatisfactory, partly because there is so much more of it, partly because there are no stained windows to speak of, and partly because the great length of the nave throws everything into perspective, with the curious result that the entire surface seems to be gilded, for the gold being applied mainly to the outer angles and projecting features catches the light, and by its glare conceals the color of the surfaces to which it is applied. It is splendid, perhaps, but it is new and garish and tiresome. The exterior, if one leaves out of consideration the great western entrance-arches, is disappointing.

The English Cathedral, Christ Church, is, on the other hand, about as interesting a piece of modern Gothic work as can be found in this country, so far as general design and proportion are concerned, but the detail is bad, bald and coarse, and the interior a very barn in its repellant bareness. The omnipresent limestone here takes on a curiously purple tone in compliment to the trimmings of Caen stone, which, on the other hand, become too obtrusive by reason of their juxtaposition with the melancholy material which composes the main mass of the buildings. An interesting chapter-house and an Eleanor's-cross kind of a structure serve to add interest and character to the group.

In the McGill University grounds is the Redpath Museum of Natural History which has quite the air of having stepped out of a page of Hittorf, and at first sight seems very interesting, though very high-shouldered, owing to the narrowness of its front and its position on a terrace. It is not helped by being squeezed up against the back of the neighboring Presbyterian College, a group in an extremely Montrealesque phase of modern Gothic. There was no one to tell which building had been built first, but if the museum was the one last built those responsible for the selection of the site were extremely injudicious.

The one other interesting building to be discovered was that built by the Standard Life Assurance Association, which would be considered a good building anywhere, but here attains unapproachable preeminence from the fact that it appears to be the only building in the city which is built of red sandstone. This fact alone would warrant the giving of an order to the attendant Jehu to rein in his steed and allow his fares to rest their eyes with something more than a passing glimpse of a bit of color. On the whole, Montreal is an interesting and instructive place to visit, but the lesson it most persistently teaches is what it is well to avoid.

SOCIETIES

AMERICAN INSTITUTE OF ARCHITECTS.

AT a meeting of the Board of Trustees A. I. A., held September 21, the following candidates were elected Fellows, viz.: M. L. Beers, D. H. Burnham, H. L. Gay, H. W. Hill, Wm. Holabird, J. W. Root, S. V. Shipman, J. L. Silsbee and A. Smith, all of Chicago. And the following were elected Associates: Otis Dockstader, Elmira, N. Y., Alfred F. Pashley, Chicago, Geo. W. Bunting, Oscar D. Bohlen, R. P. Daggett, James B. Lizius, J. H. Scharn, Adolph Scherrer, all of Indianapolis, Ind., and Chas. P. H. Gilbert, of New York City.

The Societies of Architects in Washington, D. C., and Indianapolis, Ind., were, on application, admitted as Chapters of the Institute.

The officers and members of the Washington Chapter are as follows: J. L. Smithmeyer, President; W. M. Poindexter, Vice-President; Glenn Brown, Secretary; C. A. Didden, Treasurer. Professional members: J. L. Smithmeyer, F. A. I. A., John Moser, F. A, I. A., O. Von Nerta, A. A. I. A., S. M. Howard, A. A. I. A., W. M. Poindexter, A. A. I. A., J. A. Henry Flemmer, J. R. Marshall, C. A. Didden, A. A. I. A., Glenn Brown, F. A. I. A., C. H. Reid, T. F. Schneider, A. A. I. A., Robert Stead, Wm. Kirkus, Jr., Henry H. Law, Paul Schultze, Adolph Cluss, F. A. I. A., Jos. C. Hornblower, J. West Wagner, Will. A. Freret, Edward Clark, H. L. Page, H. H. Kendall.

The Secretaries of the A. I. A., the W. A. A., the A. L. N. Y., and of each Chapter of the Institute, are *ex off.* Corresponding Members.

The membership of the Indianapolis Chapter consists of the gentlemen in Indianapolis just elected to Associateship in the Institute, together with Mr. D. A. Bohlen, F. A. I. A., its President, Mr. Lizius being the Secretary. A. J. BLOOR, *Secretary.*

COMMUNICATIONS

CORRECTIONS.

SOME weeks ago, in this department, we printed a communication, with additional comments of our own which reflected severely upon a circular issued by Messrs. Joel Goldthwait & Co.

We have since learned that the circular in question was not intended to bear the interpretation which we put upon it, and that our remarks have done injustice to an old and honorable house, and have, perhaps, created a misapprehension as to their purposes.

Such injustice and misapprehension we desire to remove as promptly and fully as possible by withdrawing and apologizing for such criticism. We are never intentionally unjust, and we desire to express our sincere regret for our error towards Messrs. Goldthwait & Co., and we trust that any papers which may have copied our original remarks will join us in publishing this correction.

EDITORS AMERICAN ARCHITECT.

GALVESTON, TEXAS, September 14, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — In giving the list of building-work now in my office, in your issue of August 27, Mr. Geo. Sealy's residence was inadvertently stated as one of my buildings. I wish to correct this clerical error, and to say that I am the superintendent of construction for Messrs. McKim, Mead & White, of New York, who are the architects of this building. Respectfully yours, N. J. CLAYTON.

TO LEARN PERSPECTIVE DRAWING.

BALTIMORE, September 18, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — Will you kindly advise me as to the best way of obtaining a thorough knowledge of perspective drawing?

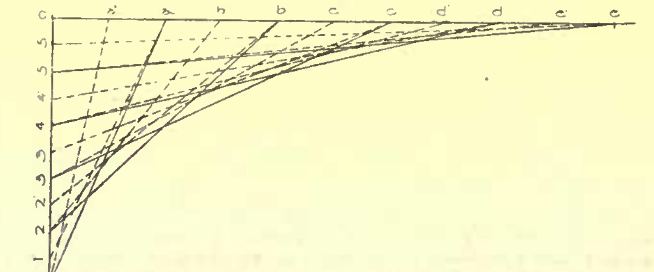
By conferring a favor in letter or paper, you will greatly oblige a subscriber. Yours very truly, EDGAR M. LAZARUS.

[MAKE a thorough study of Ware's "*Modern Perspective,*" published by Ticknor & Co., Boston. — EDS. AMERICAN ARCHITECT.]

"HOW TO DRAW AN ELLIPSE"?

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — In looking over the back numbers of the *American Architect* I came across, in Volume X, No. 293 (August 6, 1881), the short article with the above heading (without the interrogation). As a matter of curiosity, as well as being desirous of knowing the "short way" of laying out work, I tried it. I divide, in the figure shown, each semi-diameter into *five* equal parts — *a*, *b*, *c*, etc., and 1, 2, 3, etc. — and proceeded as described. Not having as many points as necessa-



ry by which to draw in the curve, I divided each part into two, making ten equal parts in each, and proceeded as before. This showed me the error of the method given, as it made two sets of lines (the solid and dotted shown), one within the other, which were to be tangent to the curve and making it possible to draw *two* ellipses to the same two diameters, which, of course, is impossible. Again, line 1–*a* is a different line from 1–*a'*, and the same curve cannot have both tangent to it. I also do not see how a curve which has either 1–*a* or 1–*a'* tangent to it can pass through the point 1, as a true ellipse is obliged to do. I address this to you, hoping to be corrected if wrong or in any

way misunderstand the rule, but if right, that you will save many from its error by the publication of this. Yours truly, "S."

[The paragraph in No. 293 needs correction, and we are glad to have our attention called to it. If the half span and the half rise are each divided into five parts, the first line should be drawn from 2 to *a*. Dividing into ten parts, the first line will be from 1′ to *a*′. In this way all the diagonals will be tangent to the same curve, no matter how many parts the horizontal and vertical lines may be divided into. The curve, by the way, is not a true ellipse, but is composed of portions of two parabolas.—Eds. American Architect.]

NOTES AND CLIPPINGS

Comfort for Advertisers.—Frank R. Stockton at one time suffered much pain in his eyes and was forbidden to read. The first day that the doctor granted him half an hour with a book his friends were curious to know what book he would select. "Give me some advertisements," he demanded, and explained, as a shout was raised, "Yes, I am pining for advertisements. My wife has read everything else aloud to me, but I hadn't the heart to ask her to read the advertisements." For several days he devoted the whole of that precious half hour to advertisements.—*The Epoch.*

Moving a Railroad Bridge in Eleven Minutes.—Two thousand people saw some wonderful achievements of engineering skill at Holmesburg Junction, on the New York division of the Pennsylvania Railroad, a short time ago, says the Philadelphia *Times*. Thirty-two men moved a distance of 50 feet the iron bridge, weighing 160 tons, that spans the Pennypack, and they accomplished the great task in the remarkable time of 11½ minutes. The engineers of the road had been long making preparations for this work. Some time ago the company decided to build a four-arched stone bridge in the place of the iron structure over the big creek. The iron bridge had to be moved westward 50 feet that it might be used until the stone bridge is built and ready for service. The removal of the bridge had to be magic-like, and between the running of fast trains. Six weeks ago the men began the big undertaking with the building of trestle approaches to both sides of the creek at the point where the iron bridge was to find a new bed. The trestling has an average height of 25 feet, and is on a level with the grade of the old road-bed. The timbers of the western approach covered about 276 feet, while the eastern approach is 300 feet long. Piles were then driven in the middle of the stream, on which was reared a strong trestle-work 50 feet long and on a level with and contiguous to the stone-pier under the bridge. Trestles of the same length and height were then built on both banks of the creek and in a continuous line from the stone abutments. These timbers were to serve both as the resting-place and as a carriage-way over which the 24-foot wide and 180-foot long bridge was to be gently moved to its new foundation. Two iron rails were then laid along the new wooden pier in the stream, and two rails on either of the new wooden abutments, and then the rails were slipped under the centre and both ends of the bridge. The rails were well greased. A "crab" is a windlass with an iron chain, and is made of heavy iron, and is triangular in shape. Four compound and four single-geared "crabs" were placed on the bridge, two at each end and four in the middle. The end of their chains were then fastened to the head of the new wooden pier on the new abutments, and the bridge was ready to be wound across the slippery rails. Long before the hour for moving it people began to flock to the scene. They came on trains, on foot, and in nondescript vehicles. An army of workmen appeared. Over 300 Italian and Irish laborers were marshalled on both sides of the bridge, while four gangs of carpenters were under it. Every man was at his post, and the great throng of people was watching with eager interest, when the whistle of the "fast line" was heard, and the train thundered over the bridge, seven minutes late. As it dashed away Superintendent Ford gave a word to his army of laborers, and it was a scene of transitory animation as they tore up rails and cut away the fastenings of the bridge. The bridge had no sooner been released than Master-mechanic Mershon gave the signal and the 32 men began to wind the "crabs." As the bridge began to slowly move men went in front of it, pouring oil over the tallow-greased rails. Superintendent Crawford and the other officers held watches in their hands as the big iron structure moved calmly toward the end of the trestling. At one time the eastern end began to lag, but it was only for a few moments, and soon the bridge slid over the rails foot by foot to its resting-place without a mishap, and in the brief period of 11½ minutes, while a mighty roar went up from the people. With lightning-like rapidity the toilers on both sides of the creek tore up and laid down frogs, switches, sleepers, and moved the rails to their new bed. They soon had the rails connected with the two tracks on the bridge. A half-hour after the bridge had been cut loose a heavy construction-train was run over the structure, and at 12:19 the Philadelphia express dashed across.

Preservation of Stone.—Limestones are, for many reasons, eminently suitable for constructive purposes, being cheap and easily-worked, but they readily absorb moisture. This, as it usually contains carbonic acid, gradually dissolves away the material of the stone, and in winter serious injury is often caused by the freezing of this water and its consequent expansion. Several methods of rendering this material less porous have been proposed, but not unfrequently the remedy has been worse than the disease. Alkaline silicates were at one time in favor for this purpose, but in its application soluble hygroscopic alkaline carbonates are formed which seriously affect the utility of the process. Moreover, unless care is taken in the application of these silicates a hard impervious varnish is given to the surface of the stone, within which the water used in dissolving the silicates is imprisoned, and on the first frost serious disintegration takes place. MM. Faure and Kessler have recently been at work on this question, and as the result of their experiments recommend the use of metallic fluosilicates, more especially those of aluminum, magnesium, and zinc. The surfaces to be treated are brushed over with a solution of the salt chosen, causing on the first application an abundant froth, due to the liberation of carbonic acid gas. When dry the operation is repeated once or twice, depending on the quality of stone, on an average for soft stones 1.7 pounds of solution at 40° Beaumé are required per cubic yard. The advantages claimed are: That the process is completed in twenty-four hours; it allows the stone to be polished, and by a suitable choice of fluosilicate used different colors can be communicated to it; and lastly, the process is cheap, and applicable not only to stone, but to all cements and mortars containing lime. The theory of the process is that a double decomposition occurs, forming in the first place, silica, calcium, and aluminium fluorides, and carbonic acid gas; secondly, a reaction takes place between the limestone and the aluminum fluorides, producing alumina, calcium fluoride, and carbonic acid. In this manner each grain of the limestone is covered with an insoluble coat, materially increasing its resistance to atmospheric influences.—*Engineering.*

TRADE SURVEYS

In nearly all lines of trade the September volume of business has been from ten to twenty per cent in excess of what it was a year ago. At this time an extraordinary distribution of goods is in progress in all parts of the country. No section of the country seems to stand out from the rest in this activity, but all are in the enjoyment of a greater degree of prosperity than usual. The manufacturing-interests have been shouting all along the line "go slowly," at the same time straining every energy to expand capacity and extend trade. No harm has resulted from this feverishness, and in all trade and manufacturing journals there seems to be a feeling that no harm is within twelve to twenty-four months. Builders who have lately spoken for themselves say that notwithstanding the financial flurry there is a vast amount of work being projected for next year. Some who ought to know predict that manufactory building will be more extensive next year than this, the reason given being that the extraordinary demand this year for all manufactured products will force an expansion of manufacturing capacity. The probabilities point strongly that way, and numerous interesting details could be summarized to strengthen the pleasing prediction, such as the urgent demand for every sort of machinery, tools, railway rolling-stock and equipments and electrical appliances, motors, etc. The increase in manufacturing establishments this year has certainly been phenomenal, and all are crowded with business as soon as wheels are ready to turn. Ship-builders of national repute on the Delaware predict several years of great activity in ship and boat yards, and prominent railroaders say that the railway-supply facilities will be crowded for an indefinite period. The present dulness in rails will soon disappear, and an advance in prices is regarded as probable, though this advance will be held in check by foreign quotations. Iron and steel makers are overrun with winter work, and prices are strong. Bridge-builders have the greatest winter's work before them they have ever had. Hardware factories, tool-makers, boiler and engine shops, and a multitude of small industrial establishments that cannot be classified are at this time sold from one to three months ahead. Hence it is but reasonable to expect a further expansion in 1888, and particularly in the new States. The Western builders have every confidence in a renewal of building activity, and in this hope they are encouraged by the best-known architects of the West, many of whom now have large contracts in hand. It is well to be able to record the fact that there is a very strong conservative feeling in trade, manufacturing and railroad circles. The necessity for a new work is carefully weighed. This spirit runs all through the industries. An urgent necessity must first exist before new enterprises are undertaken. There is less ignorant and more intelligent enterprise at the helm, and hence fewer failures, less weakness, more confidence, and a more evenly-balanced condition of production and consumption. The manufacturers of building material have entered upon an enlargement of buildings and facilities in general. In five cities where special inquiries have been made thirty new brick-working concerns will be making brick next year. On this basis a fair guess would give three or four hundred new and enlarged brick-concerns next year, and, if the truth were known, this might be a trifling number. Brick has been leaning towards scarcity all summer. In lumber, trade has, within two weeks, been stimulated in all the leading Western cities, and all Northwestern lumber manufacturers and dealers are having a large trade, but the abundance of all kinds of lumber renders high or even firm prices impossible. The manufacturers of builders' hardware and the makers of small tools report excellent winter and spring prospects. The architects corroborate most of the statements made as to the next year's activity, and go farther than mere outward facts to discount the future. They see logical reasons for saying that next year must be a very busy year in general building. There are good projects for mill and factory building in the New England States. The wage-workers of this section are in better condition as consumers than for years, a fact indicated in a measure by savings-banks reports. In the Middle States employment has been abundant and remunerative. Much shop and store building is to be undertaken in New York and Pennsylvania in the spring, and four or five long natural-gas pipe-lines will be laid, besides the construction of very large manufacturing establishments. Illinois, Iowa and Missouri seem at present to lead in enterprise in the West, as to manufacturing, those States serving the farther West with products, as did Pennsylvania and Ohio a few years ago. Business prospects are certainly encouraging to new men, and hundreds of them are being encouraged by the swelling tide of trade and business to plunge in. The latest statements as to railway earnings for eight months show an increase of fourteen per cent on the one hundred and eight roads reporting against nineteen per cent increase for the same mileage for same time 1885. The American export-trade does not show up so well as it might because of the extraordinary home demands which monopolize attention. The foundation for such a trade is being laid outside of the domain of legislation or unduly-stimulated enterprise. The competition of the lower-priced but actually-dearer labor of other countries cannot be easily overcome in the face of urgent demands and inviting opportunities at home. Financiers have been making a sham fire of the stringency of money, and those who attempt to manipulate the market will come to the same end as did the wheat-speculators and the other smaller fish who have been trying to corner the markets. Money is not as abundant as it ought to be for the fullest expansion of the nations' capabilities, but practical ways and means will suggest themselves as soon as the stringency becomes unbearable, if it ever does.

THE AMERICAN ARCHITECT AND BUILDING NEWS.

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OCTOBER 8, 1887.

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CONTENTS

A COMPETITION, the terms of which are in many respects satisfactory, while the object of it is in the highest degree commendable, is announced in New York, the Legislature of the State having passed an Act directing the Superintendent of Public Instruction to procure plans for school buildings of different sizes and cost. In carrying out this commission the Superintendent has, as we think, made a serious mistake in restricting the competition to architects residing or having offices in New York, but his statement of the requirements to be fulfilled is so thoroughly understood, and his remarks on the considerations which should influence designers show such an appreciation of the importance of good school architecture to the community, that we can easily forgive him for not knowing just the feeling of professional men on such subjects, or the difficulty of getting satisfactory results from such competitions, even without restricting the number of architects who shall be allowed to enter them; and thank him sincerely for the compliment he pays the profession in saying that a good school building exerts in itself a strong moral and educational influence, and in appealing with earnestness to architects to give their "valuable coöperation" to an undertaking of which they, more, perhaps, than any others, can appreciate the importance.

WITH Mr. Draper's opinion that the beauty, wholesomeness and convenience of a good school building exercises a great influence upon the community which uses it we fully sympathize. No one who observes young children can fail to notice how strongly they are influenced by their material surroundings. Grown people, by the help of that control over their thoughts which is the acquisition of maturity, can keep their minds pure amid filthy surroundings, and be gentle and courteous in the midst of the brutal ugliness and discomfort of a country school, but children cannot; and there is nothing more touching to a teacher than the struggles of boys and girls, who have come to the age of aspirations and ideals, against the overwhelming influence of external circumstances. A good teacher, against whose developed character such circumstances have no more power, can to some extent counteract their baneful effect on his pupils, but they ought not to be allowed to exist, and, instead of abandoning children at the most impressible period of their lives to form their minds upon models of sordid neglect, unwholesomeness and indecency, it should be the sacred duty of every community to keep the young constantly surrounded by everything that can strengthen and develop the body, and refine and elevate the thoughts. At present, the persons who can provide best for both these objects are the architects. They may not know the whole science of psychology, but they can build school-houses in which children's eyes will be insensibly strengthened, instead of being ruined for life; in which their lungs and nerves will be fortified by inhaling a pure atmosphere, instead of being corrupted by breathing "school-room air," the synonym among sanitary chemists for the foulest atmospheric mixture that human beings can inhale without immediate fatal result, and in which darkness, squalor, confusion and noise shall be replaced by light, solidity of construction, convenient and well-studied planning, and the quiet efficiency in school work which depends upon such planning. We cannot say that we think the rewards offered by the State of New York are sufficient to bring out the best possible plans, which can be produced only by an expert, after careful study of innumerable examples, but we hope that the good feeling of such New York architects as have the requisite leisure may induce them to lend their aid by sending designs which, if not absolutely perfect, will at least be far better than those on which the great majority of school-houses are built. The State asks for six plans, for buildings ranging from frame structures, to cost not more than six hundred dollars, to brick village schools, costing ten thousand dollars, and accommodating two hundred and fifty pupils, and the premiums offered are from one hundred to one hundred and fifty dollars for the best, and fifty to seventy-five dollars for the next in merit, in each class, these prizes, however, as we understand it, to be full compensation for working-drawings and specifications, which are to be furnished, if required, in addition to the sketches. The judges are experienced teachers and school-superintendents, aided by Mr. A. W. Fuller, a well-known architect of Albany, as expert adviser.

A LIVELY sensation has been caused in the profession in England by the account of a transaction which took place recently at Leeds. It seems that the School Board of that astute city bethought itself of a way of getting something at less than its value, and, being in constant need of the services of an architect, it advertised, inviting tenders from architects as to the compensation for which they would do the professional work of the Board. In most places such an advertisement would simply excite a laugh among respectable architects, but some members of the profession in Leeds seem to have either a different understanding from their brethren of what constitutes good professional service, or an abnormal notion of what such service is worth, and one firm, containing as a member a past President of the Leeds and Yorkshire Architectural Society, made a proposal, offering to do such work for a commission of three and one-half per cent on the cost of work entrusted to it. Some subsequent negotiations took place, probably managed by the financial genius of the Board, as a result of which the architects found that they had entered into an obligation to include in that modest commission the cost of taking out bills of quantities, of surveys and levels, and expenses incurred in visiting any number of existing buildings to which the Board might think fit to send them. The Board construed this last clause rather more liberally, we imagine, than the architects intended, and their first duty, after their tender had been accepted, was to obey an order of the Board to visit at their own expense buildings in nearly every county in England, besides Scotland, to gain information to aid them in designing a single school-house.

IT may be imagined that this sort of interpretation of its architect's duties on the part of the School Board reduced the prospect that its professional adviser would get much profit from his employment to a very distant one, and the other architects of the neighborhood very properly protested, both against the way in which the contract of service was made, and the injury done to the profession by the folly of the victims. Worse than this, it turned out, on investigation, that a well-known and

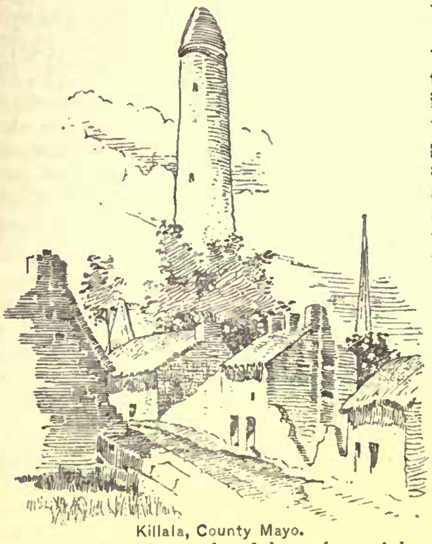
excellent architect, Mr. George Corson, one of the leaders of the profession in the North, had been approached to learn his terms for the services required by the Board, and he, understanding that Mr. Birchall of the other firm, whose standing he knew, had made a tender, replied hastily that he would do the work for the same compensation as Mr. Birchall. He did not know what Mr. Birchall had agreed to, and was very unpleasantly surprised to learn later that he had made a contract to do an immense amount of responsible work on terms which he characterized, in a communication to the Board, as "totally inadequate as a remuneration for the services required." However, the Board appears to have got him fast, as well as Mr. Birchall, and, since either of these gentlemen would submit to be ruined rather than enrich themselves, as they might, by taking the builders' twenty per cent commission to supplement the Board's three and a half, they have a doleful prospect before them. We trust that they may find some means of release in the end. Meanwhile, they must console themselves with the reflection that they have furnished a conspicuous warning to other architects who are disposed to make hasty bargains.

A PROJECT has been formed by the Paris correspondent of a Vienna paper, M. Gruneke, for securing the erection of an immense number of small houses, by means of an issue of bonds to the amount of fifty million dollars, under the auspices, but without the guarantee, of the city of Paris, which is, in return for its favorable consideration, to become the owner of the houses at the end of a term of seventy-five years. It is well known that municipal bonds in small amounts are very popular investments abroad, and where they are joined with a chance of drawing a prize in an official lottery, as is often the case, they sometimes command a very high premium, the bonds of the city of Milan, for example, which carry no interest, but give the holder a chance of a prize varying from two dollars to ten thousand, selling at sixty-five per cent premium, while those of Friburg, which are of a similar character, bring about the same premium; and M. Gruneke proposes to take advantage of this disposition of investors by issuing notes of various denominations, from one franc upward, under an agreement by which a certain number of notes is to be redeemed every year at double the face value, the amount of the notes so redeemed annually averaging one and one-third per cent of the whole issue, so that in seventy-five years the whole fifty millions will be paid off at twice the face value. In addition to this, all the bonds, though bearing no interest, carry with them chances of drawing special cash prizes, varying from fifty cents to forty thousand dollars. It is evident that this way of raising money, while very tempting to small investors in a place where loans on real-estate security bear a very small interest, is safe enough for the borrowers, who have seventy-five years in which to pay off their capital with only simple interest for twenty years at five per cent added, at the par value, and they can probably reckon with confidence that the premiums paid for the bonds would more than suffice for the lottery prizes. Of course the scheme is a charitable one, but even a charitable enterprise loses nothing by promising financial success, and the plan might perhaps be imitated with advantage on a smaller scale by building associations who wish to borrow money for their own benefit.

THE way in which associations of small capitalists can carry on building operations for their own benefit is well shown by an account given in *Le Génie Civil* of a society at Orleans. Two Orleanais workingmen, who seem to have heard of the English building societies, undertook to establish one among their friends. A company was formed, with a paid-up capital of less than fifteen thousand dollars, divided into shares of twenty dollars each. A beginning was made by buying land and preparing for the construction of houses for customers. No houses were built in advance, but persons who wished for small dwellings were provided with them at a certain price, according to the plan agreed upon between the parties, and favorable terms of payment were made. Five per cent dividends were regularly paid, and in eight years a reserve and sinking fund created, and the capital fully paid up, first to the legal extent of forty thousand dollars, and subsequently, under new authority, to eighty thousand, and during that period the society built two hundred and fifteen houses at a cost of five hundred and fifty thousand dollars, every one of which was sold before it was even begun. This method of proceeding differs materially from that of the English building societies, but it certainly has its advantages. The system of buying houses built by a company or individual seems to suit the French workingmen better than that of borrowing money to build his own house, and we are not sure that he does not save time and money in that way. One private proprietor, M. Fabien, who has built a large number of houses for poor people, testified before a municipal Commission that he found no difficulty in selling his houses at once to men who immediately occupied them with their families. He required the purchaser to pay one-half the price of the house in cash, which left him ample security for the balance, but he sold to no one without first making careful inquiry as to his character for sobriety and prudence. When, as sometimes happened, a deserving purchaser could not make the full cash payment required, he would consult with the man's employer, who would generally advance the necessary money, taking a second mortgage on the house as his security. We suppose that the roarings of the Socialists and property-confiscators have of late tended greatly to prevent in all countries the application of capital to the use of the working-people whom the apostles of theft pretend to represent, but until society is completely overturned, which will not be for a good many years yet, there could hardly be a safer investment, from the most selfish point of view, than the construction of well-planned small houses, to be sold on such terms as are the rule in Paris, while, to most men, the thought that every well-built little house sold to a prudent and honest workingman represented a family growing up in modest peace and happiness, would bring a satisfaction which successful speculations fail to secure.

A LEGAL question of interest to builders has recently been decided abroad. It appears that a certain architect, Mr. Brandreth, entered into a speculation which had for its object the erection of a circus building in a suburb of London. Brandreth had had experience in designing such buildings, but no money, and he induced two other persons, named Baker and Ginnett, to furnish funds. Several builders made estimates, based on some rather rude drawings of Brandreth's, but they proved too high, and Mr. Bickmore, the plaintiff, was called in. He met Brandreth on the ground, and was asked by him to assist in making the plans and specifications, and to estimate on them, which he did. Meanwhile, he had been introduced by the architect to Baker and Ginnett, as the principals in the enterprise. When the specifications were ready, Mr. Bickmore sent them, with his estimate, and a written contract, to Brandreth, expecting to receive from him the agreement signed. Instead of that, he received a letter, saying, "Hope to begin work on Monday, or, at least, sign your contract. You may get scaffolding on the ground when you like." The letter closed with a request that he should meet Brandreth and Baker on the ground the next day. He did so, and discussed with them the terms of payment; and on his saying that he wished for weekly payments, Baker told him that he would be prepared to make weekly payments on the certificate of his architect, Mr. Brandreth. Taking this to be equivalent to a formal contract, Mr. Bickmore went on rapidly with the building, receiving payments on account until it was nearly done, then he received a notice to stop from the architect, joined with the information that he should "require the builder to enter into a building agreement, containing the usual clause and providing sureties," before the resumption of the work. Bickmore then wrote to the architect, enclosing his account for work done up to the stoppage of proceedings. He received a reply disputing the accuracy of the account, and soon after another builder was employed to complete the structure. No notice was taken of his subsequent requests for payment, and he brought suit against Baker and Ginnett as principals. Both these denied having any interest as principals in the matter; said that they had never been introduced as such by Brandreth, and would have promptly denied the relation if they had been, and sought to throw the responsibility on Brandreth, who corroborated their testimony, and said that he was the sole proprietor and had only borrowed money of them. The judge, after the English manner, asked the jury if they thought it likely that any one would lend Brandreth money without security, or that a builder would go to work without knowing where his money was coming from, and on this hypothetical testimony from the bench, the jury at once found a verdict for the builder, with costs.

THE ROUND TOWERS OF IRELAND.—II.[1]



Killala, County Mayo.

IN the earliest ages of building, memorial architecture has always taken a form peculiar to itself, in which height was the object to be gained, and height with a base as limited in area as was consistent with safety. Proportion between width and height was not considered of particular consequence. The several parts making together the total height were all duly proportioned the one to the other, according to the appearance desired, whether massiveness, slenderness, heaviness or lightness. Naturally, the simplest monuments would be those that could be erected without the delay of special workmanship; as, for instance, the bough of a tree set up on end, or a large, oblong rock set also on end, and propped up, perhaps, with small stones; but as character was developed and tastes were formed, with the progress of civilization, it became customary to *build* these memorials—to pile up squared stones, one upon another, and to cap them with one shaped to a more special design.

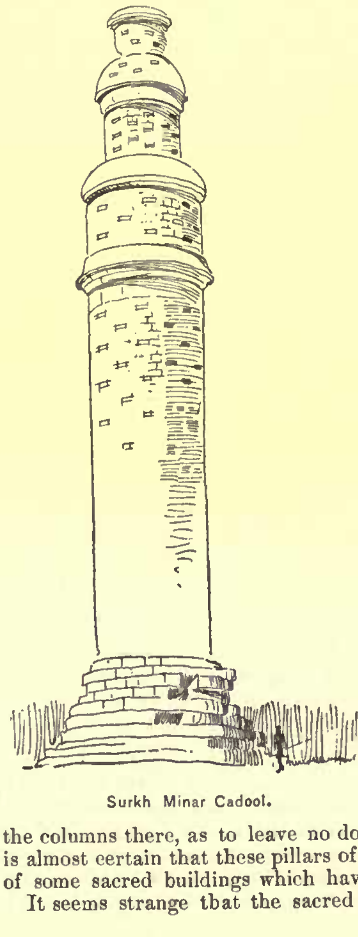
In the great building days of Egypt, when to raise huge monoliths was an every-day experience, one of these would be set on end,—perhaps roughly shaped into obelisk form; then, later, a base was suggested, and for the next monument a monolith was prepared, a base erected, and the obelisk raised on top. The dimensions of a few of the best known of these monolith obelisks of Egypt (including the bases), out of the many thousands that were erected on the east bank of the Nile, are as follows: The oldest known, standing at Heliopolis, is rather over 68 feet in height. Another, at Karnac, is 93 feet 6 inches. Several were removed from Egypt by the Romans, and no less than twelve stand in Rome itself. Of these, the magnificent one that stands in the Piazza-di-San-Giovanni, in Laterino, is 150 feet high. The two obelisks of Luxor—one of which was given to the French and now stands upon a modern base in the Place de la Concorde, in Paris—are both between 75 and 77 feet high. Cleopatra's Needle, whose later history is so well known, which, in ages past stood a giant and silent sentinel before the door of death, and now, raised on a pedestal, overlooks the noisy traffic of the Thames, in London, is, without its base, 68 feet high.

Taking the monoliths themselves apart from their bases, we find that the height is sixteen times, and often more, the diameter of the base. As they stand alone by their own weight, the full dignity of the monolith forces itself upon the imagination. A single great stone, towering aloft, all its angles worn and broken with age, its very base, its own natural widest part, having become so worn away that little flat surface has been left, it stands huge and brown in its rugged dignity, and one fancies if it had but a voice what a history it could relate. All these monuments of departed greatness were, as is well known, solid from top to bottom; the great weight of the obelisk proper necessitated tremendous solidity in its constructed base. Height was the majestic idea, and how well the ancients knew how to gain the effect they desired! Imagine an obelisk of rich granite of Syene just set up in its place, the top of the artificial base rather above the eye of the spectator as he raises his head slightly, without effort, to a point which is unconsciously fixed upon as the "point of sight," so nicely was the base proportioned with reference to the place from which it would most be looked at. From this point, without jar or hindrance, the eye naturally travels up, instead of down, along the slightly-inclined side or angle of the monolith itself until the neck is strained and the height seems much greater than it really is. The truncation of the obelisk adds to the delusion; the actual point of the apex would be lost to the near observer: then comes the projection of the brass-metal disk, which surmounted most if not all of them, to represent the sun, spreading out beyond the neck formed by the truncation, and the height of the whole would be set down about a quarter more than it actually was. Had these rigid lines been broken by however slight a projection, the sense of height would have been lost. The base constructed is nothing; it is beneath the eye line and only serves to raise the obelisk, so that no part of it escapes notice.

No attempt was made to build hollow obelisks. Lofty structures were erected all round about, but whenever there was to be a hollow space in them the base was increased to a diameter almost equal to the height of the building. While these obelisks stood alone in their character of monuments, and their form was left as specially adapted and sacred to the purpose of a memorial to the dead, other buildings were being erected throughout Egypt; palaces and temples were for the use of the living, for which entirely different forms were used. In these buildings round pillars were erected, built up piece by piece, drum piled on drum, until a great altitude was attained, and on the tops of series of these pillars rested the heavy beams of the roofs. Centuries went by; conquering armies came from the West, and returned again to their native lands, but not as they came. In their minds they had new ideas of many kinds; they had seen other lands, other people, and learned their habits, customs and life. They approved of this fashion and disapproved of that, and what they liked they carried away in their hearts, to reproduce at home. Some forms of building they appreciated; others they did not understand, and they took away with them the memory of forms congenial to them. They left the obelisks to look after themselves, but with the round pillars they went to "do likewise."

I need not here enter upon a description of the various phases of the pillar in the lands of the Greeks. I pass over the period of the dignified simplicity of the Doric column, and need no more than allude to the struggles over the Ionic scrolls and take up the line of argument again with the fully-developed Corinthian order. And what kind of column have we before us? A graceful, highly-ornate, richly-proportioned pillar, standing alone, a proof of the then known world's culture and intellectual development. It is a thing of grace and beauty, but, unhappily, in a wrong place. It is the highest type of the architecture of the day. But this pillar, standing alone as a monumental sign, although out of place without the accompaniment of entablature and pediment, fellow-columns and the walls of the temple, is an important feature. The Romans, among their trophies of war and spoils of victory, at various times brought back with them from Egypt many monolithic obelisks, but they could not appreciate the stiff, and to them unsympathetic, form, except as a sign of their conquests; they took a hint, however, and set up a Corinthian column in its graceful beauty alone, as an emblem of victory that struck in their hearts a responsive chord, and swelled their breasts with a feeling of pride. This form appealed to their imagination and roused their feelings: while the obelisk was foreign to them they felt there was life in the column. "Of the pillars of victory," says Fergusson, "one of the most celebrated is that erected by Diocletian at Alexandria. A somewhat similar one exists at Arsinoë, erected by Alexander Severus, and a third at Mylassa, in Caria. All these are mere Corinthian pillars of the usual form, and with the details of those used to support entablatures in porticos. However beautiful they may be in their proper place, they are singularly inappropriate and ungraceful when used as minarets or single columns." He mentions two others in Rome of the Doric order.

The Roman was not the only nation that used the circular pillar as a monument or memorial. Both east and west of Egypt we find the pillar in use alone, though of very different forms. In the east as in the west a pillar was taken, originally designed for use in conjunction with walls, roofs and other columns, and made to stand alone for a specific object—a pillar similar in all its details to those in front of the temples. We read of Solomon, setting up two such pillars in front of the great temple of Jerusalem, and further east in Buddhist countries we find not a few. The following description of the Allahabad pillar will, of course, serve for all in that neighborhood. To quote again from Mr. Fergusson: "It is of one stone 42 feet 7 inches in height, of which 7 feet 7 inches may be considered as base, which was probably buried to some extent in the ground, or in the masonry that supported it. The shaft, properly so called, was 3 feet in diameter at the base, diminishing to 2 feet 2 inches at the summit. The necking immediately below the capital, represents with considerable purity, the honeysuckle ornament of the Assyrians, which the Greeks borrowed from them with the Ionic order." "The pillar at Allahabad, has lost its capital, but we are able to supply the deficiency from two of the Tirhoot examples which retain their capitals, with the lions which seem to have crowned the summits of them all. In these we meet with the bead and reed ornament familiar to us in the Persian Greek architecture. The capitals are so similar to the lower members of those at Persepolis, and more especially to the bases of the columns there, as to leave no doubt of their common origin. It is almost certain that these pillars of Asoka stood originally in front of some sacred buildings which have perished."



Surkh Minar Cadool.

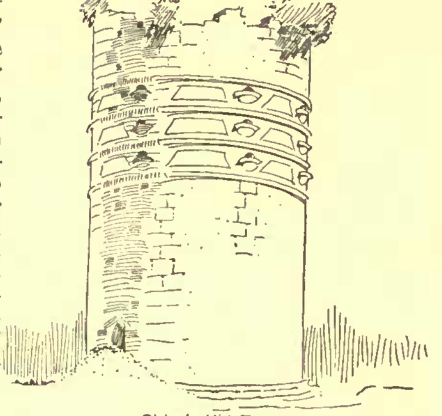
It seems strange that the sacred buildings should have perished

[1] Continued from page 146, No. 613.

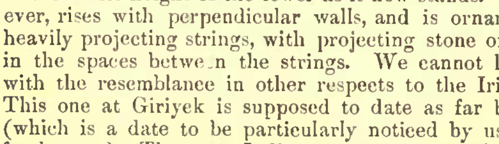
and the pillars be left. It is much easier for a solitary pillar to perish, than for a building of four walls and a roof, and these well built, too. There seems to be no other evidence to warrant this supposition, except that it was customary so to place them elsewhere — far more likely then, that they stood alone to commemorate some victory gained, or some other historical event.

But now we come to a very interesting archeological example. Miles away to the north of Afghanistan, we come upon two *built* pillars, "built monumental pillars," they are known as the "Surkh Minar" and the "Minar Chakri." "They are ascribed by the traditions of the place to Alexander the Great, though they are evidently Buddhist monuments meant to mark some sacred spot, or to commemorate some event, the memory of which has passed away. They are probably of the third or fourth century of our era, and their shape and outline exhibit great degeneracy from the purer forms with which architecture commenced in India, and which were retained to a much later period than in this remote province. There can be little doubt that their upper members are meant to be copies of the Persepolitan pillars, which were probably common also in Assyria and throughout this part of Asia."

As we travel about we become aware of the existence of hundreds of them, of different types it may be, but, nevertheless, actual built pillars, throughout the length and breadth of Mohammedan Asia. As an example, I take one of particular interest, and one about which very little is known. It is one of the earliest, and, therefore, one of the greatest importance, and considerably older than the two last named. It is situated to the south of Patna, in India, on the Giriyek Hill, and although now a ruin it is still of considerable height; possibly it was one of those attempts by which the "faithful" strove to outdo the former deeds of their brethren in the faith, by carrying up the monument of their devotion and piety to an unprecedented height, and to carry it out altogether on an unprecedented scale. This is, however, speculation, so little is known about it. It occupies a site on the summit of an abrupt cliff or precipice, a conspicuous object for miles round. In diameter it is considerably larger than others I have referred to — its particular interest to us being, its likeness in so many particulars to the round towers of Ireland: its situation is just such a one as would have been chosen in Ireland for the site of a round tower; the entrance door is placed several feet above the ground, and there are no openings or windows in the whole height of the tower as it now stands. This tower, however, rises with perpendicular walls, and is ornamented with four heavily projecting strings, with projecting stone ornaments winding in the spaces betwe.n the strings. We cannot help being struck with the resemblance in other respects to the Irish round towers. This one at Giriyek is supposed to date as far back as B. C. 600 (which is a date to be particularly noticed by us, as we shall see further on.) The great Indian topes or memorial monuments are of a different character, occupying a considerable area and rising to no great height in proportion to their diameters, but still the tower form was used, and the coins and other unmistakable proofs of their age, found in them during recent investigation, settle the dates of their erection as extending over the period of the first 600 years of the Christian era. The usual form of these topes, was a square base covering a great area, on the top and in the centre of which would be erected a tower-like structure over 100 feet in diameter, usually finished with a dome. It is the earliest rather than the latest that here I particularly call attention to, but the fact must not be overlooked that round tower-like monuments were not lost sight of, although all kinds of varieties of form crept in, and as the more modern countries were connected with the earlier ones of Asia, so the practice was carried from country to country, each nation adapting the form to their own purposes, and executing in it their own characteristics. The obelisks of Egypt have given rise to the pillars of victory of the Romans in the West. In the East the idea bore like fruit with a similar result as to purpose. From the West there was continual intercourse with Egypt and Palestine, and Palestine, as we call it now, was but the western boundary of a realm extending



Giriyek Hill Tower.



Common Form of Indian Tope.

as far east as to the centre of India under one monarch, so that from India to Rome, at least, there was a continual flow of merchandise, a traffic of all things under the sun. The travel necessitated by this commerce brought men of various nations together — helped in the interchange of manners, customs and ideas, each nation taking hold of a form it could appreciate, and adapting it to its own wants, and the form in question we have seen produced and reproduced, with strange pertinacity, varied by the characteristics of the people who adopted it, and this form in the course of a couple of a thousand years B. C. had but slightly altered in its proportions, the main outline was kept but the diameter of its area was increased. The pillar became a tower.

Again, in later years, a return was made to the pillar form, but just at the time when the pillar is developed in India, we lose all trace of it further west. True, in France, at Cussi, we find a pillar of a type quite different from the Corinthian order, which up to this had been *the* form. A pillar having an architecture of its own, of a form borrowed from India, and dating probably from 270 A. D. Its exact age, and the object for which it was raised, are alike unknown to history. It is so treated that it does not strike one as being a mere pillar, and yet the outline is not interfered with.

But the introduction of the round tower into early Christian architecture is veiled in obscurity. In the sixth century A. D. they seem to have been considered as much a part of a church as they were later. The churches at Ravenna, of that date, all have their towers, an example of which is the Church of St. Apolinare ad Classem, at Ravenna, with its circular tower and conical roof, well projecting eaves and six tiers of windows in its narrowest part. The walls are perpendicular, and the diminutions from base to summit are effected by sudden changes of diameter, not by sloping sides. It was erected at the very time that round-tower building in Ireland was in vogue; the forms, however, are totally extinct. At St. Gall, in Germany, the church erected has two detached circular towers, and it is a noteworthy fact that it is dedicated to the Irish patron Saint, St. Patrick.



Cashel, Tipperary.

The nearer we get to Ireland, the ecclesiastical towers are more and more unlike the rude structures of that country. The Gothic towers are refined and graceful and more or less ornamented, according to the dispositions of the people who built them. We find circular and octagonal towers, but few of these stand alone or merely attached to this or that church, but generally are surrounded with the church itself. The square tower takes the place of the round, the spire is added and all rudeness has been overcome. Turn to Belgium, where round towers still find favor; but here they do not stand alone, but in conjunction with square towers and the massive plain walls of the main façades. Nivelles is a church dedicated in 1045, in which the main front is flanked with two circular towers divided into stages by projecting string-courses, and carried up in slender proportions to a great height. Throughout Belgium and Germany this, indeed, seems to have been the principal characteristic of churches dating from the early part of the eleventh century — a slender tower flanking the principal façade, carried up to a great height and finished with a lofty tapering roof. But by this time (viz., the eleventh century) round-tower building in Ireland had nearly come to an end. Take England, and we find the round tower is confined to one century in connection with the churches, although it may concern us to know that in that century the round towers of Ireland were being built. For fortifications and defense round towers were occasionally used, but in most cases they differ entirely from those of Ireland. I have quoted Mr. Petrie in his remarks on Brunless Castle, but it is very probable that this form, instead of being the original, was a copy, imitated from the Irish. It is easily understood that when once the idea had taken root in Ireland intercourse with neighboring countries may very well have fostered it. That these round towers were beloved by the Irish and were peculiarly suited to them, there can be no doubt, and no other form presented itself to them as suitable to take its place.

The subject is so intricate and obscure that I put forward my theory more by way of suggestion than doctrine. There is in existence a very ancient manuscript, to be seen in the Herald's College, London, in which the great ancestor of the Saxon race, Odin, has his genealogy traced back to David, King of Israel and Judah, who abdicated about B. C. 1033, in favor of Solomon his son. Although Odin has nothing to do with the Irish round towers, the study of his descent may quicken our insight in the matter before us. There are other genealogies traceable. Upon research, I find Ireland was actually known and inhabited by descendants of David about four hundred and thirty years after his death. In the genealogies of the

Bible any one can trace for himself David's successors to a certain point, and this same list is to be found in the works of the early historians, and about these we have more details than of subsequent rulers. Of most of them we have but a few bare facts standing unsupported by any context, and one hesitates at the last moment lest one should be committing one's self. But the fact that concerns us now is that there was a king or chief, probably a near relation of King Zedekiah, who, in the year B. C. 580, fled with his wife, Tea Tephi, and his followers, from the land of Israel, and, travelling westward, finally reached the coast of Ireland, where he landed, apparently without passing through England, and as it seems, from ruling his own small company, became king or chief of the chiefs and people who dwelt there. Why he should have gone so far west, and how he came to choose Ireland as a home, is lost in obscurity, but this fact is of all importance to us. We have traced the connection between Egypt and Rome, we have gone farther and found a continual traffic between Rome and India, and now we learn there existed some sort of connection between Canaan and Ireland, and, therefore, there is a chain of commerce, perhaps, joining Ireland to India.

We have glanced at the details of monumental architecture from Egypt to Rome westward, from Egypt to India eastward, and we know the relations of Persepolis and Athens by way of stepping-stones. We have but to take a step farther and we see the rude Indian details reproduced in Ireland — the towers of Giriyek of 600 years B. C., modified, and after a lapse of a little more than a 1000 years, built again on the other side of the world. The chiefs or elders of Ireland used to meet and hold councils together. One of their council places is marked to this day by the name of the town of "Naas" (County Keldare) or the "*meeting-place of elders*," and there is still to be seen, and will be seen till the end of the world, the huge mound of earth raised, not as a monument to the dead, but as a place round which the semi-savage hordes could gather while their chiefs met in conclave in the sight of all on the summit of the mound. Here, no doubt, they met their future ruler, Heremon; from this very place spread the customs of a very far distant people, and as the centuries rolled by, the practical arts of one country were transferred to another.

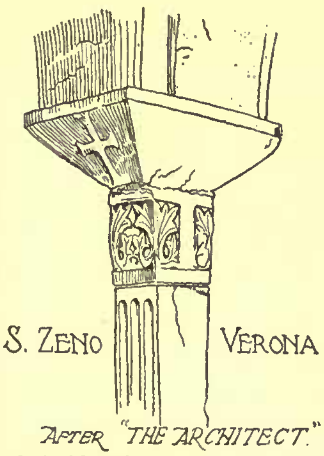
Little communication appears to have existed with the civilized world for centuries, and of the details of the history of the next thousand years in Ireland — next to nothing is known, and it is not until St. Patrick visited them early in the fifth century that we find the people anything more than semi-barbarians. With his arrival and his teaching a great change seems to have taken place, the inhabitants seem as if they had been wakened up, and for the first time they begin to build in a substantial manner. As they find in themselves a power for life and death so also they find a necessity for organized tribal protection and self preservation. To effect this the men must meet for council, and no doubt they chose some central spot in each tribal district for holding such a meeting. Then came the necessity of gathering hurriedly from all parts of the districts to unite against some foe found to be drawing near — messengers must be sent and so spread the news and call together the clansmen. Their ancestors used to mark their council-place by a huge mound of earth; they, more advanced, would mark it with a more conspicuous feature. They had learned to use stone, and what they required was some strong and lofty structure that would be seen for miles in daylight by all the warriors: traditions of which they knew not the origin gave them a form particularly suited to their purpose; national characteristics so long dormant awoke and they began to build on the line of the Indian towers. They chose a conspicuous situation whence, by a signal, perhaps a beacon, and seen through the windows of the highest story, which commanded the view all round, they could rouse the clansmen, or possibly they used bells, as Mr. Petrie believes.

To this point they would gather and decide on their plan of action, and to this tower they could look as a place of security in time of temporary trouble. So the use of their towers was threefold — it marked their council-place, it was a signal-tower in case of threatened danger, and a place of security. They had no great victories to commemorate, no heroes to whose memory they could raise a monument, but they had a purpose to effect in building, and they adapted the form they had heard of by tradition and which was fostered by St. Patrick to their necessities. As they became Christians, emblems of their faith were naturally used to ornament them, and this new idea of ornamentation soon gave rise to the introduction of further detail, and in this they were schooled by the missionaries from neighboring countries. In peace, no doubt, trade was carried on near the foot of the tower. The missionary would naturally set his abode near this, the rallying point of all the clans, and thus would a church spring up at no great distance from the tower. The position of the church with reference to the tower I regard as a matter of chance, for in no two cases does the relative position agree. In some cases as at Kilkenny there are but a few feet between the two, while, as at Kildare, there is one hundred yards, and the buildings of the monastic establishments occupied the intervening ground in this latter case, and this seems to prove that immediate connection with the church was not a requirement. St. Patrick reached Ireland early in the fifth century, at which time the natives began to entertain the idea of building. They would build roughly at first and their earlier works no doubt soon perished, while those better built would, from time to time, have required repairs, and this would perhaps account for the dissimilarity of detail existing in the same tower. Kildare was an early founded mission spot, and developed into one of the most sacred religious establishments, and the tower no doubt was of very early date. By the ravages of time the conical cap decayed, and destructive elements no doubt were equally at work wherever they could get a hold. If the roofing needed repair no doubt other parts would in time do so also, and when repairs were executed the style then in vogue would have some influence on the treatment given to the work. Thus, at Kildare, when the establishment was at its most flourishing period in the thirteenth century, under the charge of the Abbess St. Bridget, we see the doorway repaired and the new work put in enriched with mouldings and other decorative work totally distinct from the rude character of the rest of the tower, so that we cannot consider such details an evidence of the original date. The battlemented parapets witness to the same thing, and if we accept this there is no reason for us to imagine that the towers are of later date than the *fifth and early part of the sixth century* A. D., except in the case of the tower of Ardmore before described, which evidently is not an original tower.

R. W. GAMBIER-BOUSFIELD, A.R.I.B.A.

THE ROYAL JUBILEE EXHIBITION, MANCHESTER.

ENGLISH ARCHITECTURE DURING THE LAST FIFTY YEARS.



MANCHESTER may well be proud of its Jubilee Exhibition. Probably never has such wonderful "machinery in motion" ever been brought together under one roof, and certainly there has never been such a magnificent collection of English pictures as that now on view in the Fine Arts Section. Every painter of any note during the last fifty years is represented, and, for the most part, worthily represented. Through thirteen rooms the visitor wanders from gallery to gallery, each more interesting and more absorbing than another, till he is almost surfeited with the richness of the feast prepared for him. Not only are the pictures themselves most admirably selected, but they are hung with the greatest possible care — the principal works of a particular artist being brought together in a manner best calculated to show them to most advantage and to enable us to judge of his place in the hierarchy of art. Time and space in such an article as this would fail to tell of the Leightons, Poynters, Burne Jones, Rossettis, Watts, Walkers, Masons, Orchardsons, and other names familiar as household words, which crowd the walls of this glorious collection. It is the cream of all the Academies and Grosvenors and other exhibitions for the last fifty years. English painters may well feel proud of their position and of their works during the Victorian era, and one cannot but admire the liberality and public spirit of the contributors that made such a loan collection possible.

The energy of the Fine Arts Committee seems, however, to have exhausted itself in the picture galleries. The sculpture is not, by any means, commensurate with its importance; many well-known names, notably that of Gibson, are conspicuous by their absence. This is greatly to be regretted, particularly when we consider that the question of color, as applied to sculpture by Gibson, was one of the most warmly debated during the reign; nor have we anything by Alfred Stevens, the Michael Angelo of the Victorian era. Architecture comes off even worse; it is relegated to a so-called architectural court, but which is really a concert-room where organ recitals are given. Along the side walls of this prolongation of the "east nave" of the exhibition are hung some three hundred architectural drawings. No attempt has been made at chronological order, except in the most feeble manner of placing a few works by deceased architects first in the list. The sequence of architectural development during the last fifty years is altogether lost sight of, so we look in vain for anything even approaching an historical record of the Victorian era. This is the more to be regretted when we consider the importance of the movements that have taken place during the period — the rise, and shall we say almost the decline, of the Gothic revival. The revival and development of English Classic under the name of "Queen Anne," and the kindred movements of the minor acts of decoration, glass-painting, furniture, etc., which have followed in its train — anything of this kind is most difficult to understand from the drawings exhibited at Manchester; more than this, and to a greater degree than in the sculpture, we miss many prominent names from the list of exhibitors. How can any exhibition of English architecture be said to be representative, wherein the works of such men as Norman Shaw, Nesfield, Bodley, Burges, Butterfield, Cockerell, Godwin, Pugin and others are absent, while such architects as Sir Gilbert Scott and Street, are only represented by a couple of unimportant drawings? It is very disappointing — the more so after the magnificent collection of paintings. One looks through the meagre array of drawings, some of them very bad *drawings*

indeed, with a sense of injury and lack of interest, a conviction that something is wrong somewhere that could result in such an unfortunate display.

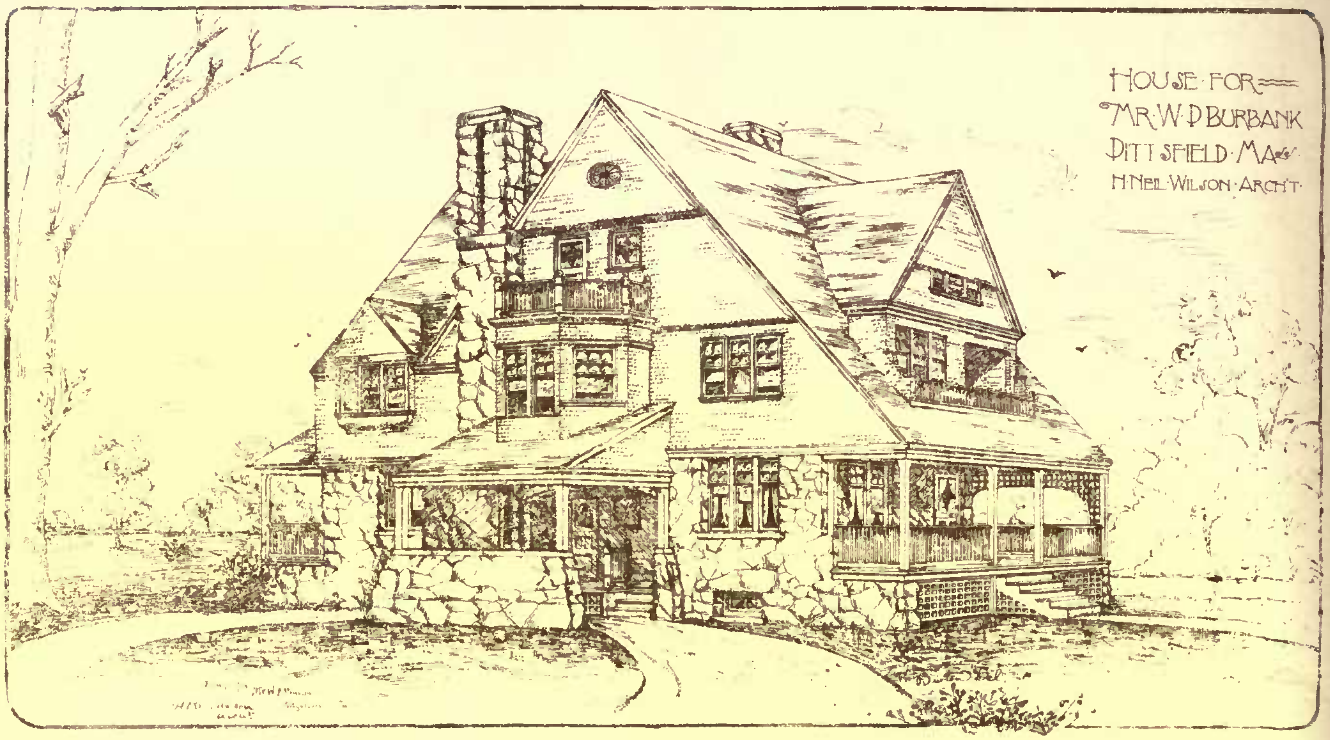
Fifty years ago architecture in England was a very different thing from what it is now. As a fine art it was at a low ebb. From the end of the last century the Greek revival had been going on with more or less success. We had been trying our hardest to acclimatize the monumental art of Greece to our everyday English wants, no matter whether it happened to be a palace or a gate-lodge — and were just beginning to acknowledge what a hopeless failure it all was. We were rapidly coming to the end of our first "revival" — during which, for the first time in our architectural history, we had practically failed to impart into our work a distinctly-national character. A reaction, therefore, had set in, feebly at first, but presently to receive a mighty impetus from the first great public building of Her Majesty's reign — the new Houses of Parliament. Of this historical work, a large careful drawing of the rear front is shown at Manchester, besides Sir Charles Barry's unexecuted designs for New Palace yard — all these, especially the first, are most interesting, and with it may be fairly said to have begun the Gothic revival. A whole school of Mediæval artists, including the great Pugin, arose during its progress, and from this time onward our second "revival" grew in strength, and its works in number beyond all precedent. For the first half of the Queen's reign the "national" style was everything, not that, as we shall see presently, the Renaissance architects were beaten out of the field altogether; far from it; even the designer of the Houses of Parliament himself was one of the strongest of their number, his Classic works probably, as art, being of a far higher standard than ever he reached in Gothic. But the "revival" is the first important event in the architectural history of the reign. It is curious and deeply interesting to observe how, at its first inception, the later types of English-Gothic were taken as its models; how, under the influence of Ruskin's writings and the publication of many admirably-illustrated works on Continental-Gothic, it passed through the various phases of Italian and French, and even performed a kind of harking-back process to our own earlier types, and then slowly but surely returned, in the main, to our later English-Gothic once more. As we have said, it is a pity that so few of the famous men who took part in all this historic work are represented at Manchester. Of Sir G. G. Scott we have only his houses at Broad Sanctuary, Westminster, and St. George's church, Doncaster (built about 1856). Of Mr. Street, we have only his northwest porch, Bristol Cathedral, and his designs for the Law Courts for the Thames Embankment site (*the* site), both beautiful drawings by his own hand. Among the earlier workers (some of whom, indeed, are still with us), we have no names of any note, with the exception, perhaps, of Mr. B. Ferrey, who is represented by his St. Stephen's Church and Schools, Westminster, in geometric Gothic, and built about 1846, and Wynnstay, a country house in North Wales, designed in a kind of French Classic, of Mr. Pearson, who has been building churches for over forty years. Of Mr. Butterfield, his contemporary all that time, there is nothing — a most unpardonable mistake in an exhibition with any pretentions to be representative. The Classic men of the first half of the reign fare but little better. Decimus Burton's Charing-Cross Hospital and United Service Club, Pall Mall; Sydney Smyrke's Carlton Club, Pall Mall, his spoilation of the old Burlington House by an additional story for the Royal Academy, and his Pavilion for Prince Albert, with Edward Walter's Free-Trade Hall, Manchester, almost exhaust the list. None of Sir Charles Barry's wonderful Classic clubs and houses are here, nor anything of Professor Cockerell's except a fine drawing of his own for the sculpture in the pediment of St. George's Hall, Liverpool. St. George's Hall itself — the greatest Classic building of modern times — is not shown; neither is the Royal Exchange, London, by Tite, the British Museum, by Smirke, nor the Fitzwilliams Museum, by Basevi. All these had been done while the Gothic revival was yet in its first growth, before it had made any impression on the domain of civic architecture. Such was the force of the revival, however, and the ardor of it advocates that it could not be expected our public buildings would long remain uninfluenced, and curiously enough it was reserved for Manchester to lead the way. Mr. Alfred Waterhouse, with the Assize Courts in 1859, and again with the Town-Hall ten years later, showed what could be done with secular Gothic. He being Manchester's most famous architect, we expect him to be well represented, and we are not disappointed. His principal works from the Assize Courts to the National Liberal Club, on the Thames Embankment, except the Manchester Town-Hall, but including the Natural-History Museum, and the Technical Institution at Kensington, and Eaton Hall, the Duke of Westminster's country palace, near Chester, are shown in his own drawings. They are the most typical works of the Victorian era, thoroughly eclectic in character, full of purpose, and distinctly nineteenth century in tone and feeling in spite of the particular phase of Gothic or Renaissance employed. They represent more than any other the versatility of the architecture of the day, and nowhere could we hope to find this more appropriately shown than in Manchester, or more ably carried out than by one of her sons. Indeed, it might almost be called the "Manchester School," and has plenty of followers. Mr. Waterhouse has probably had the largest practice of any architect of the age, and the most important commissions. Had he been as great artist as utilitarian, it is more than probable he would have revolutionized English architecture as greatly as did Inigo Jones or Wren. As it is, his work but reflects too faithfully the passing fancies of the hour, the latest of which is the revival of "terra-cotta" as a building material even for the largest and most monumental public building. In spite, however, of these extraordinary works by Mr. Waterhouse, in spite of Mr. Street's Law Courts (or shall we say because of them?), and of many other clever works by clever architects the strength of the Gothic revival still lay in its ecclesiastical aspect. Here all through the reign it may be said to have grown from strength to strength until, after its return to more strictly English types, we have among us men capable of designing work which can hold its own with the best periods of the Middle Ages. Not so much in the letter, for different requirements have produced different results, but in the true spirit of the style, and the artistic power with which it is handled, we have become masters of church architecture in English-Gothic.

The secular and domestic side of the revival has always been its weakest. The reason is not far to seek. The life of the Victorian era is not that of the Middle Ages. Later types were, therefore, more and more followed and developed until we have had a third "revival," that of the so-called "Queen Anne," or English Classic. Beginning about the middle of the reign with country houses of late sixteenth and seventeenth century type, the movement gradually assumed a more Renaissance feeling, until at the present time the Classic element is once more attaining the ascendency. Of the works of the men who were mainly instrumental in bringing about this "revival" — second only (if that) in importance to the Gothic which preceded it — the works of men like Mr. Philip Webb, Mr. Nesfield, and Mr. Norman Shaw — none are shown at Manchester. There are several, however, by younger men, followers of the school, which illustrate the enormous change that has of late years come over the spirit of English civil and domestic architecture. Of these the works of Graham Jackson, at Oxford, occupy a prominent place — notably, his well-known Examination Schools. Similar in spirit, though somewhat different in type, we have the works of Mr. Champneys, at Cambridge, Oxford and Harrow; Mr. Collcutt's Wakefield Town-Hall, and other works in London; Mr. Brydon's in London and Chelsea, which show the gradual Classic tendency of the revival until we come to the Municipal Building, at Glasgow, by Mr. William Young, a Renaissance structure of the most pronounced type, represented at Manchester by an elevation and perspective. This latter, the largest public building now erecting, brings the record down to the date of the Queen's Jubilee. Of the many important and civil works erected during the latter half of her reign only a few are here. Of these, as representing the Classic tradition, which had never been wholly swamped by the Gothic revival, those by the sons of Sir Charles Barry are very interesting: Wykehurst, Sussex, and the City Terminus and Hotel, Cannon Street, London, by E. M. Barry, are shown; — while by his brother Charles there are Dulwich College, Burlington (new) House, Piccadilly and Clumber House, the Duke of Newcastle's big country seat; the latter, shown by plans, elevations and a perspective view of the great hall, is a splendid specimen of a large Renaissance mansion, rivalling the Gothic Eaton Hall for size and importance. Like it, also, it was a rebuilding and restoration of an older house.

As might be expected, the Manchester architects are well represented. We have the Royal Exchange (interior and exterior) by Messrs. Mills and Murgatroyd, the Police and Sessions Courts by Thomas Worthington, the Manchester and Telford Bank, by Henry Lord, and other public buildings, and if we are anxious to see what can be made of a Manchester warehouse, we have a drawing of the huge and well-known "Watts," by Messrs. Travis and Manghall, and a whole group by Mr. Edward Walters and others. These enormous warehouses are characteristic features of Manchester street architecture, like nothing else anywhere, and they all belong to the Victorian era.

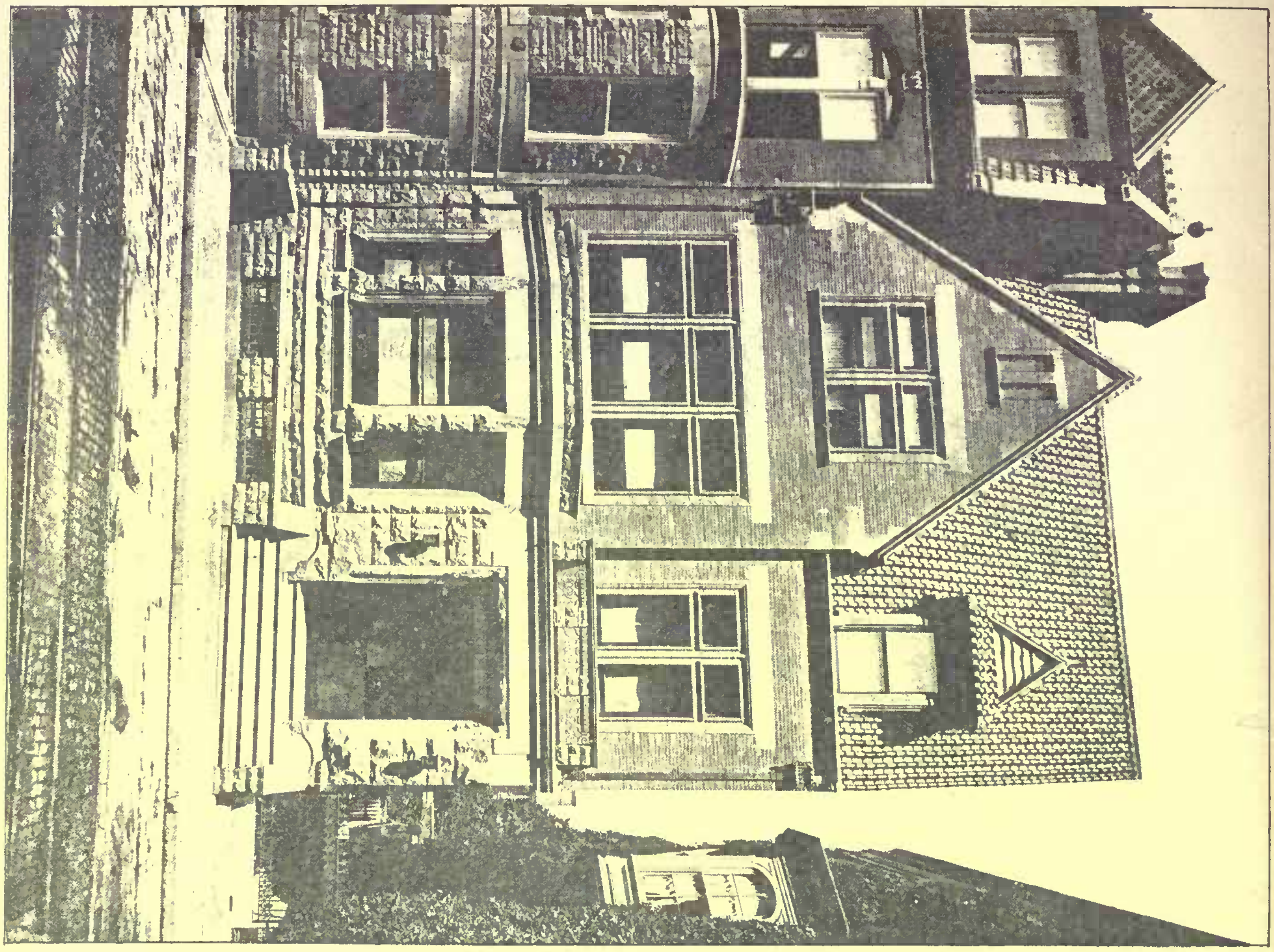
Our empire beyond the sea is not forgotten, and it is here represented by the works of Mr. Emerson in India — including his well-known Muir College in Allahabad, All Saints' Church, Allahabad, and the Takhtsingji Hospital, Bhavnagar, all works distinguished by their clever adaptation of Indian architecture; while Mr. John O. Scott sends us views of his cathedrals at Lahore and the Falkland Islands — the former a striking work in red brick, of lofty proportions and with two western towers.

Thus, though far from adequately, the display gives us an outline of the development of architectural art during Her Majesty's reign, and looking back over the fifty years' work we are confronted with a result never before found in our architectural history, that we seem to have a multiplicity of styles all flourishing side by side. We have witnessed two distinct and important revivals, one Gothic, and in the main ecclesiastical, the other Classical, and in the main domestic, but both eclectic in the highest degree. Moreover, some process of amalgamation has also been going on in which the forms and details of the one have been adapting themselves to the principles of construction of the other. Whether the movement in favor of English Classic may yet result in the development of a Victorian style in the future it is impossible to say. The tendency, if towards any result at all, seems to be in the mean time to take it for granted that we have one style for the church and another for the world of every-day life, a Sunday and a week-day style, which are becoming more and more distinct from each other; so much so that we find the same men practising both with equal skill, but strictly reserving each for its own purpose. We venture to think the Victorian era stands alone in

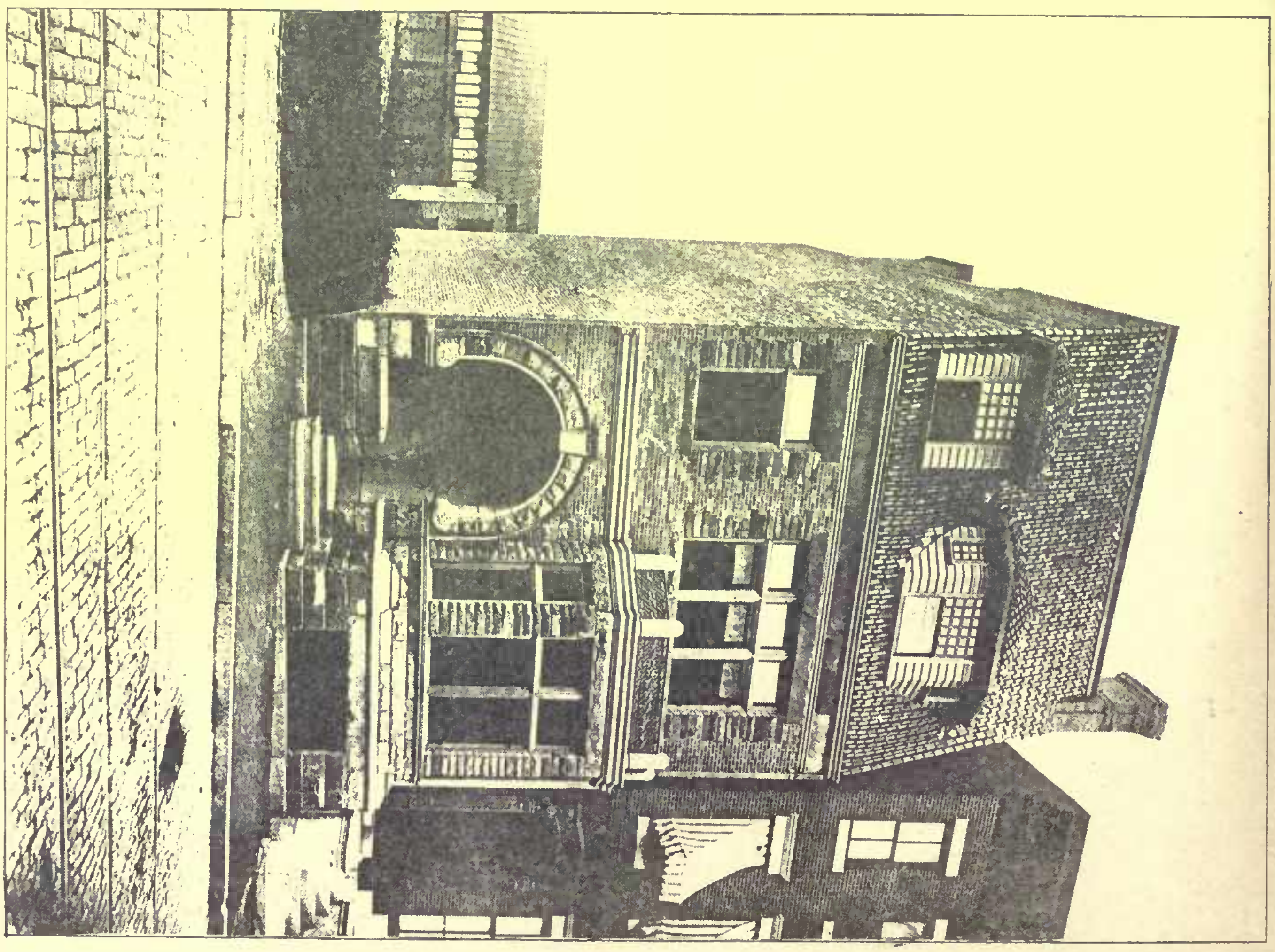




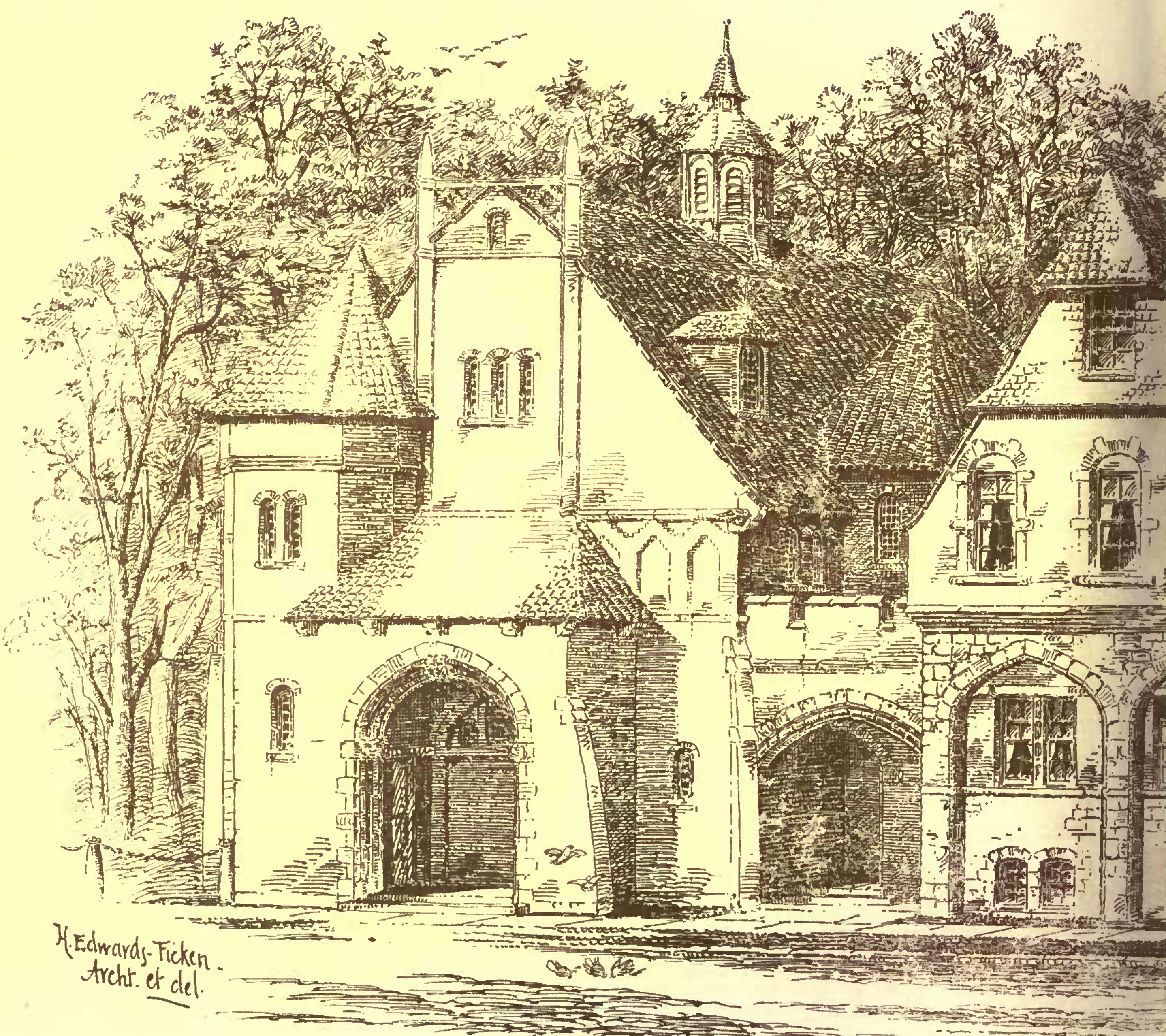
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Baltimore Club House, Baltimore, Md.

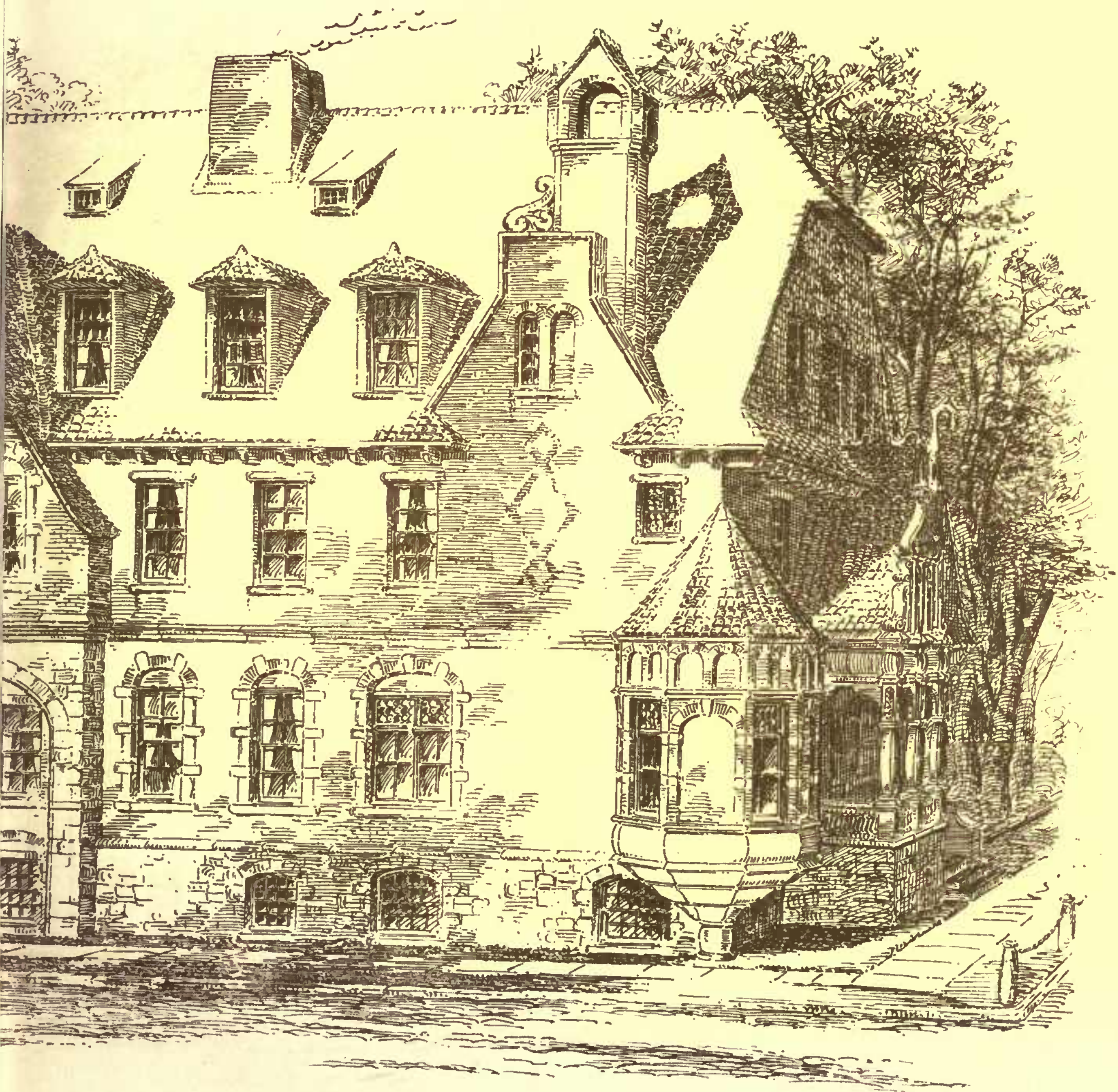


House of Edward Reese Esq, Baltimore, Md.



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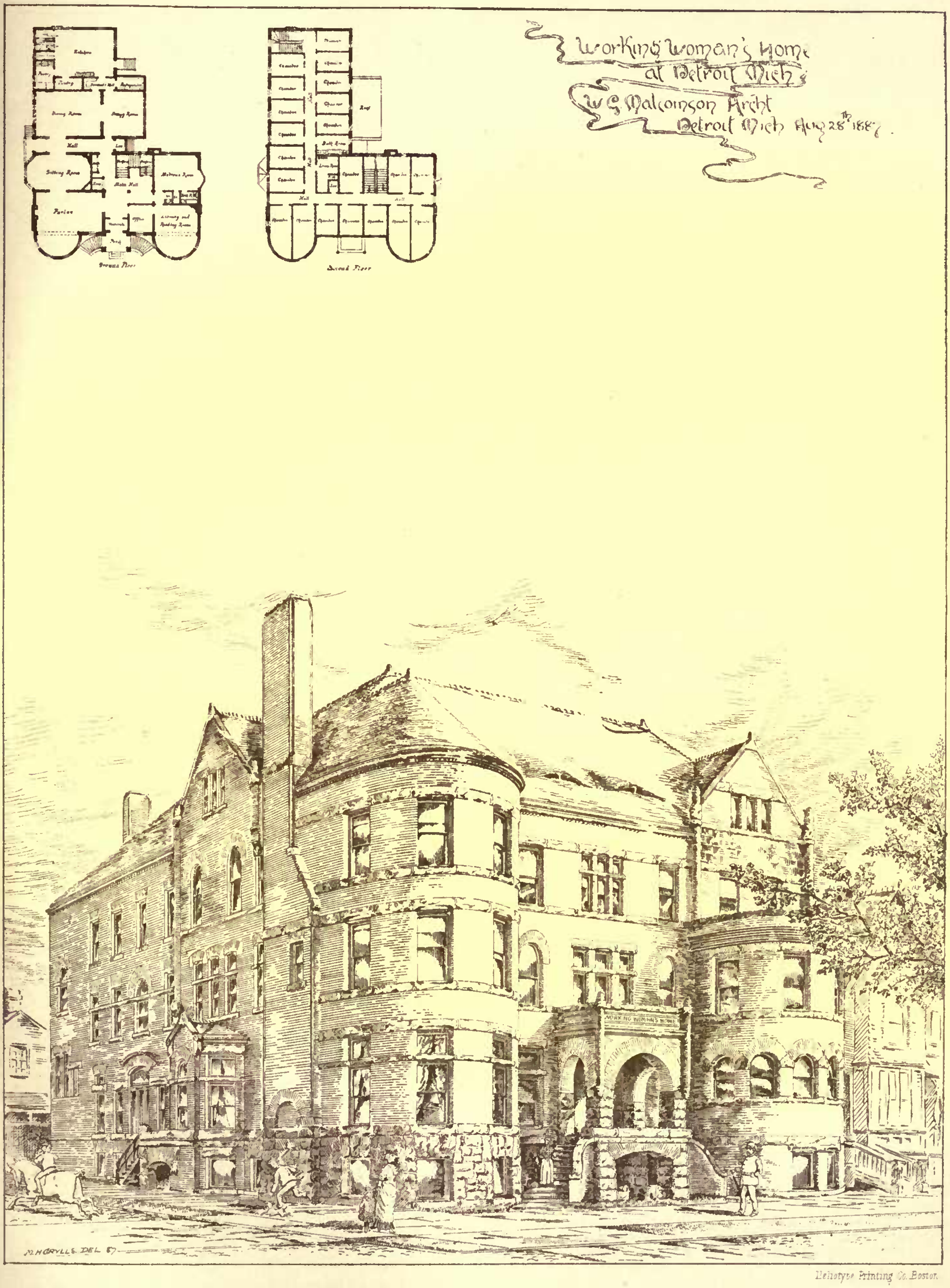
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such a characteristic. Only within the last fifty years has it received such decided, and lately, one might almost say, such accepted acknowledgment. True, all through the Greek revival the Mediæval tradition had never quite died out. Gothic churches of a sort were still erected here and there, but the wave of Greek touched alike church and hall, town and country architecture. Now we find the Gothic revival has virtually abandoned the domain of civil work, and the new Classic has apparently accepted the compromise, since its promoters never attempt churches in their favorite style, but retreat at once to the safer and more familiar paths of English-Gothic. Even a pronounced Goth, like Mr. Bloomfield, when he comes to build a bank in Fleet Street, and that, too, under the shadow of Mr. Street's Law Courts, takes refuge in Classic, and Mr. Young, when designing a town church for Chelsea, falls back at once on Gothic, as if by instinct, yet he is a Classicist in everything else! It is an extraordinary state of things, one which may be well worthy of the thoughtful attention of all those who have the best interests of their art deeply at heart, but on the outcome of which it will be useless to speculate. The Victorian era is not yet closed. Judging from its activity in the past, its knowledge and power in the present, we may with confidence leave its future to the historian of the century. Writers are fond of contrasting it with the Elizabethan age in art and in letters: let us hope its architecture may yet come bravely out of the comparison with honors.

THE ILLUSTRATIONS

[*Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.*]

THE CUSTOM HOUSE, QUEBEC, CANADA.

[Gelatine print, issued only with the Imperial Edition.]

THE BUILDING FOR THE STONE TRUST ASSOCIATION, NEW HAVEN. MR. H. EDWARDS-FICKEN, ARCHITECT, NEW YORK, N. Y.

THESE buildings now erecting on the corner of Hillhouse Avenue and Grove Street by the Stone Trust Association are for the use of a secret society in the scientific department of Yale University.

The cloister part of the buildings will be occupied by members of the society, and the chapel will be its meeting place.

The building will be of local New Haven red stone, with red-tile roof and red tiles facing the gables. The main entrance to the cloister will be on Grove Street, through a pillared and sculptured porch, opening on a large hall, columned and beamed overhead, and with a large carved brick fireplace at one end, the main stairs at the other. The general plan of this building is a large study between two bedrooms, each study having its own open fireplace. Bathrooms and all other conveniences are provided on each floor, and every attention has been paid to light, ventilation, heating and plumbing.

THE NATIONAL BANK OF COMMERCE, MINNEAPOLIS, MINN. MR. H. W. JONES, ARCHITECT, MINNEAPOLIS, MINN.

THIS building is to be entirely fireproof, and fitted up in the best manner possible for a first-class office-building. The material will be brownstone, with a brown granite base. The bank quarters will be on first floor at the corner of the building, and will have its own entrance, the main entrance being for the remainder of the building, and will be on a level with the sidewalk, the elevators being entered on the same level. All the plumbing will be confined to the basement, the water-closets being under the sidewalk. The cost will be about $175,000.

THE BALTIMORE CLUB-HOUSE, BALTIMORE, MD. MESSRS. J. A. & W. T. WILSON, ARCHITECTS, BALTIMORE, MD.

THE Baltimore Club-Building has a width of 34′. All stonework is of dark red Potomac sandstone. Red brick above first story especially made for this work, 15″ long. Windows faced with moulded brick, and transom bars and lintels of red terra-cotta. Dormer of hammered copper. Roof of dark glazed tiles. Vestibule of polished red Georgia marble.

HOUSE OF EDWARD REESE, ESQ., BALTIMORE, MD. MESSRS. J. A. & W. T. WILSON, ARCHITECTS.

THIS house has 25′ frontage. The materials are North River bluestone, with selected weather-stained faces, brown brick and dark glazed-tile roof. Dormers lead; vestibule finished in polished Knoxville marble.

ACCEPTED DESIGN FOR THE WORKING-WOMEN'S HOME, DETROIT, MICH. MR. W. G. MALCOMSON, ARCHITECT, DETROIT, MICH.

THIS building is to be located on northeast corner of Adams Avenue and Clifford Street. Principal front on Adams Avenue 80′; Clifford-Street front 100′. Materials: red brick and Berea stone trimmings. Principal rooms finished in red oak; balance, pine. Estimated cost, completed and heated by steam, about $28,000.

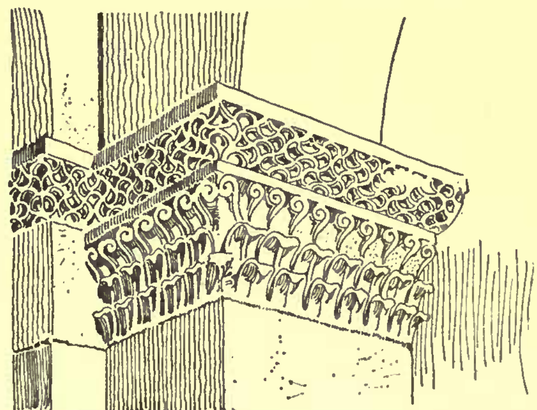
HOUSE OF W. P. BURBANK. ESQ., PITTSFIELD, MASS. MR. H. NEILL WILSON, ARCHITECT, PITTSFIELD, MASS.

THE material of which this house is composed is as follows: first story, rough boulders, all colors, from old fences in neighborhood; second story, red wood (cedar) shingles, oiled and creosoted; trimmings painted dull yellow; interior finish of white-wood, painted. Cost $22,000.

SKETCH FOR GRAMMAR SCHOOL, WATERVILLE, ME. MR. JOHN CALVIN STEVENS, ARCHITECT, PORTLAND, ME.

BUILDING MATERIALS.[1] — VI.

CAPITAL FROM TRAÜ. DALMATIA.



After the Builder.

HYDRAULIC CEMENTS. (*Continued.*)

THE great improvements that have been made in the manufacture of Portland cement within the last twenty-five years, owe their origin in a great measure to its having been employed in the construction of sewers for the Metropolitan Drainage, under the superintendence of Mr. Grant, who, with the view of obtaining the best possible article that could be manufactured, devised certain definite tests by which the quality of supplies could be controlled. The terms of his first specification were "that it should weigh 110 lbs. per striked bushel, and that briquettes made up with water and having a minimum area of $2\frac{1}{4}$ square inches, after immersion in water for seven days, should not break under a tension of 400 lbs., equal to 177 lbs. on the square inch." Such a limit appears to be absurdly low, now that we are accustomed to cements which well bear a tension of from 400 to 450 pounds on the square inch, and yet, some eminent cement manufacturers of that time gave it as their opinion that a strain of 133 pounds on the square inch was as much as cement could be expected to stand. Although the seven-day test with neat cement is still very generally adopted on account of the inconvenience which a further delay in ascertaining the quality of supplies would entail, it is admitted that with hard-burnt, slow-setting cements, a period of twenty-eight days would allow of much more satisfactory results being obtained. Tests should also be made with a mixture of one part of cement and three parts of clean, sharp sand; briquettes made of this mixture should be put in water twenty-four hours after they have been made, and at the expiration of twenty-eight days bear a strain of 250 pounds on the square inch. It is important that the same description of sand should be employed in all cases, the particular kind of sand now very generally adopted is that obtained from Wortley Field sand-pits, near Leighton Buzzard. The grains of sand should also be of uniform size, and only those portions should be employed which have passed through a sieve of 900, and been retained by one of 1,600 meshes to the square inch. Inasmuch as the finer grinding of any cement makes its weight per bushel lighter, the actual specific gravity of the cement (which should be 3.1) is now regarded as a better criterion of its quality.

A new method of calcining cement has been proposed by Mr. Frederick Ransome, which yields very promising results. It consists in the use of a furnace composed of a revolving cylinder placed in an inclined position, and lined with fire bricks or other refractory material in such a manner as to produce a number of parallel longitudinal ridges, or "feathers" through the entire length of the cylinder. The fuel employed is gas obtained from slack coal, by means of an ordinary gas producer, the air necessary for its combustion passing through a regenerator heated by the waste heat from the revolving furnace. The slurry is lifted to a hopper placed at the upper end of the cylinder, from which it falls in a steady shower through the flame of the burning gases, which enter at the lower end of the cylinder. The slurry, as the cylinder revolves, is caught by the "feathers," and is lifted until the feather attains such an inclination

[1] A lecture by W. Y. Dent, F.C.S., F.I.C., read before the Society of Arts, and published in the *Journal* of the Society. Continued from page 150, No. 613.

as to shoot it off to the bottom again, but owing to the inclined position of the cylinder at every revolution, gradually nearer to the lower end; this occurs repeatedly, until the completely-calcined cement falls into a receptacle at the lower end of the cylinder, which is rotated at such a speed as to allow about half-an-hour for the cement material to pass from one end of the cylinder to the other. It is obvious that such a method must possess several important advantages:

1. The cement when it leaves the cylinder is in the condition of a coarse powder, some of the particles being about the size of beans, instead of being in heavy lumps of hard clinker; it is consequently capable of being easily ground to a fine powder, which is not the case with the ordinary cement clinker.

2. A very considerable saving of fuel is effected, the consumption being estimated at not more than one-third of that required in ordinary kilns.

3. The temperature is completely under control, and the cement is not exposed to a high temperature for a longer period than is necessary for perfect calcination, whilst every particle is subjected to the same amount of heat; the cement is consequently of a more uniform character.

4. The plant required is of a less expensive character than is necessary with ordinary or circular kilns, a cylinder of about four feet in diameter and twenty feet in length, being regarded as capable of turning out as much cement as a thirty-ton ordinary kiln.

The most important point to be determined in the analysis of Portland cement is the proportion of lime, which in a well-made cement should be from fifty-eight to sixty-two, or perhaps sixty-three per cent. Any excess of lime should always be regarded with suspicion, inasmuch as it is well known that by increasing the proportion of lime, the strength of briquettes made of such cement at the end of seven days may be augmented. An excessive amount of lime, however, cannot be employed without incurring the risk of the cement cracking and becoming disintegrated.

When the lime is associated with magnesia, the magnesia should be regarded as to some extent taking the place of the lime and the quantity of the lime should be proportionally diminished. A well-prepared Portland cement, such as is made on the Thames or the Medway, should not contain any appreciable quantity of magnesia, say about one per cent. Although any large proportion of magnesia in Portland cement cannot be considered desirable, yet it must not be forgotten that magnesia is capable of forming hydrates of great permanence and hardness, and that some very good hydraulic cements contain as much as eight per cent of magnesia, such, for example, as the well-known Rosendale cement of the United States of America.

There can be little doubt but that the assertions that have been frequently made as regards the tendency of cements containing magnesia to disintegrate may sometimes have arisen from overlooking the fact that the results observed might be due to excess of basic constituents in the cement. In a recent statement put forward as to the injurious action of magnesia, the cement referred to contained seventy-two per cent of lime and magnesia, and it could scarcely be regarded as extraordinary that such a cement should prove a complete failure, since it is well known that such a proportion as seventy-two per cent of lime would render any Portland cement so unsafe as to cause it to be condemned.[1]

One of the materials of which it has been attempted to make cement similar in its character to Portland is blast-furnace slag. Many endeavors have been made from time to time to utilize a material for which, until a few years ago, no application could be found except for road-making purposes. A great number of patents have been taken out with the view of accomplishing this object. In 1864 the plan of subjecting the melted slag (as it runs from the furnace) to a powerful jet of air or steam, was proposed by Mr. Geo. Parry, which causes the slag to assume the appearance of wool. This slag-wool can be used for a variety of purposes, and, being a bad conductor of heat, is well adapted for use as a covering for boilers' steam-pipes.

When we recollect that this slag consists principally of silica, alumina, and lime, and that the silica is in a condition in which it is more readily capable of entering into new combinations than it is when in the form of clay, it might be expected that we have in blast-furnace slag a material peculiarly calculated to be of service in the manufacture of cement, artificial stone, or mortar. Accordingly we find that, as far back as thirty-seven years ago, attempts were made to utilize slag for such purposes. In 1850 a patent was secured by Mr. Jos. Gibbs for the manufacture of mortar and artificial stone by mixing ground slag with lime. The subject was subsequently taken up by some of the owners of ironworks, and a method for working slag was devised by Mr. Chas. Wood, of Middlesbrough, by the adoption of which he estimated that slag could be reduced to the condition of slag-sand at a cost of a few pence per ton.

The molten slag is made to flow into a bath of water, which is kept in a state of violent agitation by a revolving cylinder provided with a series of perforated screens or buckets, by which the slag is separated into small particles and carried up into a spout, which conveys it into trucks placed to receive it, the water falling back into the bath through the perforated screens. Many thousands of tons of slag-sand have been manufactured in this manner, from which mortar is prepared by grinding the slag with five per cent of lime, the mortar setting so quickly that it is necessary to use it within twenty-four hours of its having been made. Bricks are also manufactured in vast quantities by mixing the slag-sand with ten per cent of slaked lime, and pressing the mixture into bricks, which, when dry, are ready for use, without requiring to be subjected to the heat of a kiln.

Attempts have long been made to manufacture a cement resembling Portland, from slag-sand, but until recently without leading to any very successful result. If care be taken in selecting the slag-sand, in ascertaining its composition, and in mixing with the proper proportion of chalk, very excellent cement may be produced, for the calcining of which Ransome's revolving cylinder is especially adapted. The slag-sand cement, prepared in a proper manner by what is called the homogenized-cement process, as promoted by the Improved Cement Company, certainly gives results which are somewhat surprising, since *briquettes* made of this cement, whether tested neat at the end of seven days, or mixed with three parts of sand at the end of twenty-eight days, will stand the same tension-test as good Portland cement. At the same time it must be borne in mind that great caution is necessary in adopting a cement of this nature, more especially when it is recollected that blast-furnace slags differ materially in their composition, and it is therefore not surprising that the introduction of a cement of this unusual character should have much to contend with as regards want of confidence in its power to retain its good properties for any length of time, more especially as previous experience on the subject of cement would tend to lead to the conclusion that no sufficient combination of the silica and alumina with the lime could be brought about by mechanical mixture alone, however intimately the substances might be incorporated with each other. It would appear, however, that when care is taken to see that the constituents of the cement exist in suitable proportions, a very serviceable article is capable of being produced. The cement is prepared by simply mixing together, in the most intimate manner possible, slag-sand and dry well-slaked lime, without subjecting the mixture to any firing process. The secret of the success that has attended this method of making cement would seem to be the result of the very intimate mixture that is obtained by means of a revolving metal cylinder containing a number of iron balls, favored by the soft and somewhat spongy character of the slag-sand. In this, as well as in all new descriptions of cement, time is necessary to discover its defects or establish its merits. If a cement made in so simple a manner will continue to increase in strength for as long a time and to the same extent as Portland cement, this slag-sand cement must become an important branch of manufacture; but at present its lasting qualities are not sufficiently established to allow of its being employed for any important work without the engineer incurring a little responsibility. It has, however, been clearly proved that a very excellent material, capable of being used as cement-mortar, can be made out of slag-sand by this method.

Some excitement has lately been created by numerous letters which have appeared in the newspapers on the results produced by mixing sugar and lime together, for the manufacture of mortars and cements. Unfortunately, these communications have seldom given sufficient details of the nature of the experiments made to enable any one to say how far the results described are due to the sugar or to other causes. A mixture of sugar and pure lime made into a paste will set very hard upon the surface, but the interior of the mass remains in a friable condition, and will not withstand the action of water. Sugar may possibly be used with advantage where only pure lime is to be obtained, but it is not probable that any such mixture will compete in strength and durability with a good hydraulic lime.

Amongst the most recent novel applications of cement are those of Mr. Wilson, of Grays, Essex, who, by enclosing in the cement wire-netting and hoop-iron, so strengthens it as to enable him to construct cisterns and drain-pipes that will stand very rough treatment, without being inconveniently heavy. He also constructs telegraph-poles, as well as a variety of other articles for which cement has hitherto been considered as unsuitable.

PLASTER-OF-PARIS.

The setting of cements like Portland and Roman is due to combinations of a somewhat complicated character, the precise nature of which is far from being distinctly understood. It is altogether a different question with respect to plaster-of-Paris which is due to hydration only. Gypsum is sulphate of lime combined with water, and when exposed to a temperature of about 360° Fahrenheit, the water is driven off, and anhydrous sulphate of lime, known as plaster-of-Paris, remains. Sulphate of lime is found in nature in the form of transparent prisms, as selenite, and in opaque and semi-opaque masses, as alabaster and gypsum; it is also found not in combination with water, in which condition it is termed anhydrite. The principal beds of gypsum belong to the Tertiary system, the finest of these deposits being those of the Paris basin in the district of Montmartre. In this country it is found most abundantly in the counties of Derbyshire and Nottingham, extensive plaster works being carried on in the vale of Belvoir, a short distance from Newark, where the gypsum occurs in beds varying in thickness from a

[1] From a recent report of Professor Brazier on the cause of the failure of some Portland cement used in the construction of a graving dock in Aberdeen Harbor, it would appear that the reaction which takes place between the magnesium chloride contained in sea water and lime may, under certain conditions, be sufficient to cause the disintegration of some descriptions of Portland cement, the lime in the cement being dissolved.

few inches to three or four feet. The only preparation which the gypsum undergoes previous to calcining consists in chipping off the outer portions, which, being contaminated with earthy matter, would injure the color of the plaster. With all the varieties of gypsum there is a tendency to assume a crystalline character, and accordingly, as it possesses less or more of this structure, it is described as dense, granular, or fibrous. The white translucent alabaster which is used in statuary is a compact mass of crystalline grains, so soft as to be capable of being easily turned or cut. The altar-piece in the chapel at Chatsworth is a fine example of alabaster work. Gypsum, when finely ground, is known in the color trade as terra-alba, and is used to a considerable extent in the manufacture of colors.

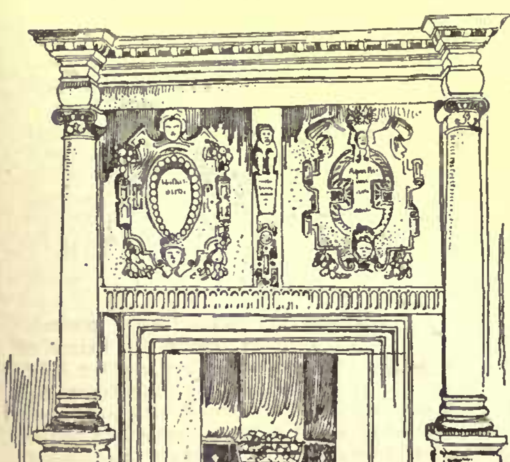
It is however, in the form of plaster-of-Paris that sulphate of lime is of the greatest value in commerce and in the arts. For its production several methods of heating the gypsum are adopted, a flat kiln or oven being generally employed in this country. After raising the kiln to a temperature of a low red heat, the firing is discontinued, and it is charged with the lumps of gypsum, which, after about eighteen hours, has lost its water of hydration, and become converted into plaster-of-Paris. The kiln is sometimes worked continuously, and is heated by flues which are carried round the chamber in which the gypsum is placed; when this method is adopted, it is necessary that care should be taken that the temperature does not rise too high, and that the plaster is withdrawn as soon as the water has been expelled. Considerable experience is required in carrying out this process (which is simply one of dehydration) successfully, for although when the temperature is kept within proper limits the plaster possesses the power of reabsorbing its water with avidity, yet this power is diminished if the gypsum be overheated. When subjected to a red heat for some time, the gypsum increases in density, and if this temperature be continued, it gradually assumes the character of natural anhydrite, which does not possess the properties of plaster-of-Paris. It is safer not to drive off the whole of the water rather than risk exposing the gypsum to too high a temperature, as the retention of a small portion of its water does not prevent the plaster from reabsorbing the water that has been driven off.

Although plaster-of-Paris does not chemically combine with more than one-fourth of its weight of water, yet it is capable of forming a much larger quantity into a solid mass, the particles of gypsum being converted into a network of crystals enclosing mechanically the remainder of the water. The value of plaster depends upon this property of setting with a very large quantity of water, for if the plaster were not capable of being used in the condition of a thin paste, its value as a material for taking casts would be greatly diminished; the thin plaster, when poured into a mould, fills every cavity, and the slight expansion which takes place in the act of setting forces it into the finest lines of the mould. Sulphate of lime is soluble in water to the extent of one part in four hundred, the solubility being but little influenced by temperature. It is on account of this solubility in water that cements which consist in a great measure of plaster-of-Paris are incapable of bearing exposure to the weather.

By mixing gypsum with a small quantity of certain salts, such as alum, borax, and sulphate of potash, it is rendered capable of bearing a higher temperature than ordinary gypsum, without injury, and the character of the plaster produced is altered; the mixture setting into a harder material or cement, of which we have examples in the cements known as Keene's, Parian and Robinson's.

[To be continued.]

CRIMINAL FIRES IN THE UNITED STATES.



MANTEL. WRAXALL MANOR. ENG.
AFTER THE BUILDER

FROM a paper entitled as above, read at the annual meeting of the Fire Underwriters Association of the Northwest held at Chicago, by Franklin Webster, editor of *The Chronicle*, the following copious extracts, embodying the greater part of the paper are printed in the *Spectator*. The subject is one which Mr. Webster, as compiler of *The Chronicle* Fire - Tables, is peculiarly fitted to discuss, and his treatment of it will be found highly interesting, we believe:

We have in the United States an annual loss by fire which is moderately estimated at $100,000,000. One part of this loss is due to fires whose causes are purely accidental; another and a large part is due to fires originating from carelessness in its countless forms; a third part, also considerable, is due to fires which are the result of deliberate crime.

The crime of arson or incendiarism or "fire-raising" — whatever may be the distinction between these names in popular usage or legal terminology, they mean the same for the present purpose — has always and everywhere been regarded as one of the basest in the calendar. Considered simply as a thief who steals from society, a thief who often takes that "which not enriches him," the incendiary is more to be dreaded than any other thief on the face of the earth. The property he takes away is gone forever. There is no way of wooing its return by a promise to ask no questions. It is hopelessly gone, and society must stand the loss. The burglar, with knowledge of locks and skeleton keys, may, to a limited extent, levy on the goods of others, but the incendiary's torch is much the superior tool. There is, practically, no limit to the property it places at his mercy. With it he can reach the treasury of society, and, as we must admit many times has been the case, make drafts thereon through the medium of insurance.

We have a great deal of fire in the United States. It takes a great deal of fire to burn $100,000,000 of property values every year. How much of this fire is of criminal origin? This is a question which no one can answer with precision, for there are no data from which to figure out an exact percentage. The statistics which, in the main, I shall use as a basis for the conclusions reached in this paper, viz., *The Chronicle* Fire-Tables, show that during the years 1884, 1885 and 1886 there were 44,216 noteworthy fires in the United States. Causes were assigned for 21,055 of these fires, the causes of the remainder being either not reported or stated to be unknown. Of the 21,055 fires whose causes were given, 5,459 were attributed to incendiarism, that is, about twenty-six per cent of the whole number of fires of known origins. As I have intimated, this cannot be considered an exact percentage, but I think it may safely be accepted as a fair approximation to the truth. It may be that the admitted unreliability which attaches to all reports of fire causes, not officially determined, has had the effect of prejudicing the incendiary's case by counting against him suspicion as the equivalent of fact, but on the other hand it may be argued, and certainly the majority of fire underwriters believe, that many of the fires whose origins are called unknown are due to incendiarism in disguise. Assuming that the one possibility may offset the other, it seems wise to get our probabilities from what we are warranted in terming, comparatively speaking, the fires of known origin. Hence, we arrive at the probability that twenty-six per cent of the fires annually occurring in this country are wilfully caused, and consequently criminal in their nature. In my opinion this is a tolerably close measurement of the numerical proportion of incendiary fires. . . .

Once in a while somebody who has suddenly become impressed with a sense of the enormity of the loss by incendiarism, raises his voice to denounce the whole system of fire insurance, alleging that insurance companies are responsible for criminal fires, that there is but one motive for incendiarism worth speaking of, namely, the cupidity of over-insured persons. I think a very little study will disprove this theory utterly. Reckless practices by companies and agents, the one anxious to do a large rather than a safe business, and the other filled with a mania for commissions, may render the conditions easy for dishonest policy-holders to fire their premises, but possibly the influence thus exerted has been much over-estimated. Let us turn our attention for a moment to finding out, if we can, some of the motives for incendiarism. Several weeks ago I read in the *American Exchange and Review*, of Philadelphia, that the accomplished editor of that journal, Dr. J. A. Fowler, knew twenty or more different kinds of incendiarism. I asked him what they were, and will now read you his classification:

1. The incendiary policy (moral hazard).
2. The incendiary for gain or advantage other than insurance.
3. The revengeful incendiary (fires of feuds).
4. The discharged employé.
5. The malicious servant.
6. The rioter.
7. The tramp.
8. The thief (for concealment of theft).
9. The thief (for opportunity for theft).
10. The murderer (for concealment of crime).
11. The incendiary for murder.
12. The mischievous small boy (or girl).
13. The contriver for incendiary reward.
14. The fire-bug, or fire-conspirator (terrorizing by fire).
15. Incendiarism from momentary rage.
16. The drunken incendiary.
17. Incendiary firemen.
18. The don't-care bonfire kindler.
19. The don't-care pyrotechnic exploder.
20. The don't-care manufacturer of unsafe kerosene, etc.
21. The "pyromaniac."

The "pyromaniac," as Dr. Fowler remarks, cannot be considered a legal incendiary; neither can 18, 19 and 20 on his list, "but they bring the trespass so near the crime that they can be admitted into the insurance catalogue of incendiaries as being practically such." Possibly this long list might even be extended, but it is sufficient as it stands to show that all the incendiarism is not attributable to over-insurance. Indeed, one cannot read the newspapers intelligently

without discovering an abundance of incendiarism not due to insurance. . . .

If more evidence is needed on the point that property destroyed by incendiary fires is not in the aggregate heavily insured, a few statistical facts may be mentioned. The fires of last year described as incendiary were in number 1,959. By these fires a money loss amounting to $7,769,690 was incurred on the property in which the fires originated. The loss to insurance companies on the same property was $3,933,882, leaving a net loss of $3,835,805, which fell upon the owners of the property. In other words, the owners were indemnified through insurance only to the extent of fifty-one per cent of their actual loss. In the face of this showing it is the idlest of talk to attribute incendiary fires solely, or principally, to a motive to realize on insurance policies. What motive can insurance give a set of men to burn one dollar's worth of property in order to be repaid fifty-one cents? Another fact should be noted. The average insurance on the entire amount of property burned in 1886 was fifty-eight per cent, consequently we have before us the fact — very difficult to reconcile with the assertions frequently and recklessly made that insurance furnishes the motive for incendiarism — that the property said to have been destroyed in the United States in 1886 by incendiary fires was actually insured to a smaller extent than property in general destroyed by fires from all causes during the same period. There is still another point that should not be passed by. Although the mean amount of incendiarism in fires as a whole is twenty-six per cent, as stated, the amount of incendiarism varies in different classes of risks. For instance, fires in tobacco-barns are about eighty-five per cent incendiary; in country stores, about sixty-seven per cent; in jails, about sixty-six per cent: in rinks, about sixty-six per cent; in livery stables, about sixty-three per cent; in slaughter-houses, about fifty-nine per cent. Now, it ought to follow if the theory that insurance furnishes the motive for incendiarism is to be borne out, that these classes of risks are heavily insured. But they are not. Many insurance companies will not write policies on these properties. It does not at all seem to be the case — as it ought to be if insurance furnishes the motive — that the percentage of uninsured loss runs down as the ratio of incendiarism runs up. On the contrary, nearly all the classes of property distinguished for intense incendiarism show large property losses in excess of the amounts of insurance paid, and this fact appears to prove conclusively that property having a high moral hazard is pretty generally known and avoided by fire-insurance companies.

In any fair study of the causes of criminal fires, no other conclusion can be reached than that private enmities, business rivalries, mischief, malice, race-prejudices and hatreds, factional quarrels, jealousy, religious intoleration, fire-raising for purpose of theft or to hide theft, fire-raising for purpose of murder or to hide murder, labor troubles, and so on, correctly account for the majority of incendiary fires.

The distribution of incendiarism by months and seasons is not without interest. The crime of suicide is known to be comparatively frequent in certain months and infrequent in others. The same peculiarity marks the distribution of other crimes. The monthly curves of incendiary fires during the four years ending with 1886 show that whatever the number of criminal fires in January, there are likely to be fewer in February; March is likely to have more than February, April more than March, and May more than April. In June the incendiary takes a rest. In July he is a little busier than in June, with a tendency to be very active in August and September. He is generally more riotous in October than in September, while in November he manifests an equal inclination to increase or diminish his business. In every year of the four there have been fewer criminal fires in December than in November. A chart of the average monthly number of incendiary fires in the United States for the same four years shows that criminal fires are much more numerous in the months of August, September, October, November and December, than in the seven remaining months of the year. The greatest number of these fires is attributed to November, but this result appears to have been mainly due to an intensity of incendiarism in November, 1886, which may have been an outgrowth of the widespread labor troubles prevailing last autumn, or possibly to other causes. This monthly distribution of criminal fires is decidedly queer. For four years the number in January, May, June and July has been singularly uniform. The months in which the fluctuations of the incendiary wave are most pronounced are September, October and November. Indeed there seems to be an extraordinary regularity in the number of criminal fires in the first six months of the year; we find the chief irregularities and widest fluctuations in the last half of the year. And we find another thing, viz., that in this period criminal fires, taking the whole country, are excessive compared with the earlier months.

The geographical distribution of criminal fires is, of course, a matter of importance. The ratio of incendiarism seems to range steadily higher in the Southern States than in any other part of the country. In the annual summing up of fire causes for the past three years no less than sixteen States have reported over one-half of the fires within their borders, whose causes have been given, as incendiary. Twice in three years Arkansas, Kentucky, West Virginia, Nevada and Connecticut have reported this proportion of criminal fires. The short period covered by the statistics, however, does not permit the acceptance of these results as exact, but as far as they go they are interesting and probably foreshadow the truth. It is plain that we must find the explanation for incendiary tendencies in the character and occupation of the people and the nature of their surroundings. Ignorance and illiteracy do not satisfactorily account for the prevalence of the crime in one section more than in another. Incendiarism is by no means a crime peculiar to the uneducated. But it does appear that a large percentage of persons sent to prison for arson are entered on the prison registers as having no trade or settled means of livelihood.

We have learned from the monthly distribution that during the months when there is the greatest activity in the agricultural districts criminal fires are comparatively frequent, that they are especially numerous in the time of year devoted to harvest. Moreover, during the months when most of the great crops are growing, there is a lull in the reports of incendiarism. It may seem anomalous to those who have schooled themselves to think that incendiary fires proceed from an owner's or occupant's purpose to make money by firing his own premises — in other words, from inherent moral hazard — that incendiarism should be rampant in the season of harvest and plenty, when granaries are bursting with the products of the soil, and the farmer is on the eve of realizing a money return for his year's work. There is, however, nothing strange in this peculiarity if we profit by the teaching of observation, namely, that the greater part of incendiarism is due to other causes than the burned-out persons' desire for self-gain. The bulk of incendiarism originates outside of owners or occupants; it comes, so to express it, from moral exposure — from revenge, malice, jealousy, mischief and similar motives. It is, therefore, not to be considered remarkable that farm property should be burned at a time when the loss will be most keenly felt by the sufferer. We are not compelled to eliminate altogether the motive of self-gain to account for the excess of criminal fires about the harvest period. A declining market, an upward turn of the rates of transportation, an inferior quality or scant quantity of the crop, not to mention other possible discouragements, may operate as a motive for incendiarism if there happens to be an abundance of insurance around. I shall venture the conclusion that the record of incendiary fires by months, the preponderance of agricultural risks in the annual list of criminal fires, the experience in other countries, notably in Prussia, where incendiarism in the agricultural regions is from three times to four times as frequent as in the cities and towns, all tend to demonstrate that the proportion of incendiarism in different States and sections is determined, other things being equal, by the relative extent of their agricultural areas. The nature of the chief product, whether cereals, cotton or tobacco, the tenure of the land, whether by ownership or by renting, and the density of the agricultural population, are secondary influences. It is worthy of record that the wave of incendiarism reaches its highest altitude in the tobacco and cotton States.

For the purpose of finding out what the public is doing in the matter of convicting and punishing incendiaries, I addressed a circular letter a few weeks ago to the wardens of the State prisons and penitentiaries in the various States, asking information respecting the number of prisoners on hand at the last report, and the number on hand at the same date serving sentences for incendiarism. Responses were received from thirty-eight institutions, representing thirty States and territories. The whole number of prisoners reported was 31,176. How many of these convicts do you suppose were sentenced for arson or incendiarism or attempts? Only 486, or about 1.56 per cent. Apparently, it is good work if the people, by their own efforts, manage to put as many as 100 incendiaries behind the bars in the course of a year.

The present prison population of the United States is approximately 60,000. If 1.56 thereof are incendiaries, then there are to-day 936 persons in the United States undergoing punishment for the crime of arson. But nearly one-half of the whole number of prisoners are confined in county jails, houses of correction and reformatories, and among this class there is a low percentage of incendiaries. Consequently, if we place the number of "fire-bugs" now confined in penal institutions at 600 or 700, probably the estimate will be liberal. Now let us recall that during the three years ending with 1886 there were 5,459 criminal fires — which undoubtedly means close upon 5,459 incendiaries — among the fires whose causes we know something about, and we can get a fair notion of what the public is doing, rather should we say what it is not doing, in the way of punishing incendiaries. How many criminal fires were hid away in the great aggregation of unknown and not reported causes can only be conjectured. We can afford, for the moment, to concede that among the fires of unknown and not reported origins there was not a single incendiary fire, and still charge upon the people a failure to convict one incendiary in twenty.

What are fire underwriters to do? The only way they can meet this intense moral hazard is by stretching the premiums. They do so and then the gentlemen from the red-hot rural parts go down to next winter's session of the legislature and vote for a valued policy law, vote into force a statute which has the effect of increasing whatever part of incendiarism is really due to a motive to get insurance money. Underwriters may do another thing. They may try, and they have tried, to spur up the people by showing how incendiarism can be detected and convicted. The National Board went into the business of offering rewards years ago, but it failed to accomplish any great amount of good either in the direction of stimulating people to do better work in punishing incendiaries or in reducing the percentage of criminal fires by "making examples." The latest

statistics for arson and incendiarism in the different States, is compared with the National Board's "tabulated statements showing the number of imprisonments and terms of sentences for arson and incendiarism in each State during the years 1865 to 1876, both inclusive," do not reveal any noticeable improvement, numerical or otherwise, in the punishment of incendiaries. It does appear, however, that as the fire underwriters took it upon themselves to detect and prosecute criminals of this class, the public vigilance relaxed. Of the arson convicts imprisoned in the New Jersey State prison at the last report, no less than forty per cent were National Board men; those convicted by the National Board's efforts in the State of New York amount to twenty per cent of the arson convicts in Sing Sing and Auburn; in Connecticut twenty per cent are National Board men; in Maine one of the four; in Rhode Island one of the two; in Vermont four of the seven are National Board men. In the State prison of New Hampshire — a State which has deliberately thrown all the obstacles it can in the paths of fire insurance companies — there are two prisoners sentenced for arson, both of them National Board men. Fire underwriters have done all they reasonably can be expected to do to suppress incendiarism. They have informed the people of the extent of the crime, and have stepped outside of their legitimate business to become prosecutors. But the public has neither been apt to learn nor thankful for service, and has shown a disposition to augment the burden rather than assist in lightening it. And that is practically its attitude to-day.

A sneak thief may steal overcoats or silver plate, he may sometimes take away a few hundred dollars of value, but the prowling incendiary, every time he applies his torch, robs society of nearly $6,000. Such was last year's average.

We have seen that the property losses by criminal fires reach an enormous figure, that the aggregate is of a magnitude equal to the total losses by the fires of one-fourth of the year, that inferior police regulations and other causes place the agricultural districts in the front place as regards intensity of incendiarism, and that the passions and weaknesses of human nature which have existed since the world began, and not the insurance policy, are responsible for the majority of criminal fires. Whether it is worth while for the people to make an earnest effort to repress incendiarism is for them to decide. They can go on paying-in their insurance premiums, the price of their revenge and jealousy and bigotry and hatred and lawlessness, they can remain blind to the acts of the incendiary and punish him with leniency or not at all, but they must foot the bill. Exactly how the people should proceed to repress incendiarism I shall not undertake to say, further than to remark there seem to be two essentials in the way of a beginning: (1) fire coroners in every county, whose duty it shall be to inquire into the causes of fires; (2) a decent enforcement of present laws relating to the crime of arson. I think the opinion is universal that the failures of justice which we see around us every day are due not so much to a lack of proper laws as to the non-enforcement of them. At its last meeting the National Prison Association of the United States saw fit to adopt a resolution reading as follows: "Promptness and certainty in the detection and punishment of crimes are the chief agencies by which society can protect itself against the criminal class; the deterrent forces of the law now lose a great part of their value through the needless delays, uncertainties and irregularities of our criminal jurisprudence: we earnestly recommend such changes in the laws and in their administration that judgment against crime shall be executed with certainty and speed." When the crime of arson shall be punished with promptness and certainty there will be much less of it, and the people can save money in two ways — by preserving millions of dollars' worth of property now destroyed every year by criminal acts, and by obtaining from fire insurance companies the lower rates of premium they are constantly praying for. Until moral hazard, in any branch of underwriting, is circumscribed by the rate of premium, insurance business is impossible. When the people compel fire insurance companies to meet an almost unrestrained incendiarism, when they compel them, as it were, to build a premium wall around sheol, they must understand and expect that the cost will fall upon them. If the fire-waste of the year should assume the characteristics of the tornado, and sweep across the nation from coast to coast, confining its destructiveness to one narrow path, there would be no failure on the part of the public or the press to realize the immensity of the devastation. Nor would there be a failure to realize the extent of the waste by incendiarism, nor a failure to perceive the necessity to adopt the most vigorous measures to repress this crime, if it should appear — as by the present statistics it would appear — that the part of this desolate track lying between the city of Chicago and the Atlantic ocean represented the proportion of the whole fire loss due to criminal fires.

SOCIETIES

FIRST ANNUAL COMPETITION OF THE ARCHITECTURAL LEAGUE.

THE Architectural League takes pleasure in announcing that it has instituted, in connection with its Exhibition, an Annual Competition, open to all draughtsmen in the United States under the age of twenty-five. The object of such competition to be the promotion of good design and the improvement of draughtsmanship.

As prizes, it offers to the design placed first, a gold medal, to be known as The Gold Medal of the Architectural League; and to the design placed second, The Silver Medal of the Architectural League.

The conditions for admission to the competition are:

1. That the competitors shall be residents of the United States, and under the age of twenty-five; and —

2. That the drawings shall be made in conformity with the following programme, and, in all parts and portions, entirely by the hand of the competitor.

The drawings will be judged by the jury appointed for that purpose. The successful drawings, and such others as may be thought worthy, will be hung at the Exhibition, the first and second prize-drawings being so indicated, and these latter shall thereupon become the property of the League.

For the First Annual Competition the following programme has been arranged:

The drawings shall exhibit a "Memorial Clock and Bell-Tower on a Village Green." The tower to stand on a base which shall not exceed the dimensions of a square of twenty-two feet.

Each contributor to exhibit two sheets of drawings: one to contain plans and elevations at the scale of four feet to the inch, and one to exhibit a perspective view. The plan-and-elevation sheet to be finished in line with India ink and the lining-pen. No brush-work on this sheet, except in blacking-in windows and sections. No shadows are to be cast. The perspective sheet to be rendered at will. Each sheet to be cut to the uniform size of 24 by 32 inches, and to be white card or Bristol board, or Whatman paper, mounted on stretcher. No colored borders, frames, or glazing will be allowed. Each sheet must be distinguished by a motto or cypher. A sealed envelope, bearing the same motto or cypher, must contain the name and full address of the author.

Drawings are to be delivered flat, carriage paid, on or before December 5, 1887, to Chas. I. Berg, Secretary, 152 Fifth Avenue, New York City. They will be returned at the close of the Exhibition at the expense of the contributor.

JOHN L. DU FAIS, *President.* CHAS. I. BERG, *Secretary.*

WM. C. HAZLETT, }
JOHN L. DU FAIS, } *Committee.*
CHAS. I. BERG, }

ILLINOIS ASSOCIATION OF ARCHITECTS.

THE annual meeting of the Illinois State Association of Architects was held at its rooms last week Saturday, October 1. The election of officers for the ensuing year resulted as follows:

President, Samuel A. Treat; First Vice-President, L. D. Cleaveland; Second Vice-President, C. L. Stiles; Treasurer, H. W. Hill; Secretary, R. C. Berlin; Executive Committee, L. H. Sullivan, W. W. Clay, John W. Root and Alfred Smith.

The Treasurer announced the following figures:

Cash on hand October 1, 1886	$1,099.52
Receipts during year	1,096.75
	2,196.27
Disbursements	1,481.10
Balance on hand September 30, 1887	715.17

Mr. John W. Root, for the Executive Committee, announced that as a result of the concert of action with the Chicago Chapter of the A. I. A., the sessions of the annual meeting of the American Institute of Architects would be held in the New Art Institute Building, and that the Leland Hotel had been made the headquarters of the members who should attend the meeting.

COMMUNICATIONS

A CORRECTION.

CLEVELAND, O.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — Please note item of building intelligence in issue of September 3. The Hollenden Hotel on Superior Street — we are not the architects — but Geo. Hammond, of this city.

Very truly yours, COBURN & BARNUM.

NO REDRESS FOR STEALING EXECUTED DESIGNS.

NEW YORK, September 26, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — Will you please inform me what redress, if any, one may have when an exterior detail — say, an elaborate entrance to a private building — is deliberately measured off and literally reproduced by a firm of builders, without sanction from either owner or architect? Yours truly, WILLIAM B. TUTHILL.

[UNLESS the design was copyrighted, we do not think there is any redress, as the law now stand in this country. — EDS. AMERICAN ARCHITECT.]

ANOTHER UNRULY CLIENT.

September 28, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — A man called wanting a $5,000 house, exacting more than that amount of money would procure. I remonstrated at every new requirement, assuring him it would overrun his figure. He was very irritable when I spoke thus, and told me he was an old builder and knew what he could do. After many changes and additions all

made under protest by me, his drawings were finished. Soon after he called, having learned from some builder who had seen plans in the office that they would cost over $5,000. He said he was satisfied with them if they could be built for $5,000. I told him they would cost $7,000, and asked him to take and pay for them. He declined. I placed the matter in a lawyer's hands, directing him to compromise if possible. The lawyer sent for him. He called and said he would take plans and look them over and return them next day, and probably make an offer of settlement. He has not done so, but I learn he has been taking bids for two months, and expects to build. Please give your opinion of the case. Respectfully,

PRACTITIONER.

[THIS client seems to be rather slow pay, but our advice would be not to hurry him too much. There is no indication that he does not intend to be honest, and the architect may console himself for waiting by the reflection that the acceptance of the plans implied in building from them will remove the last pretext for refusing to pay for them in full.—EDS. AMERICAN ARCHITECT.]

NOTES AND CLIPPINGS

STEAM-PIPE FOR HEATING PURPOSES.—The *Master Steam-Fitter* gives the following rule for finding the superficial feet of steam-pipe required to heat any building with steam: One superficial foot of steam-pipe to six superficial feet of glass in the windows, or one superficial foot of steam-pipe for every hundred square feet of wall, roof, or ceiling, or one square foot of steam-pipe to eighty cubic feet of space. One cubic foot of boiler is required for every fifteen hundred cubic feet of space to be warmed. One horse-power boiler is sufficient for 40,000 cubic feet of space. Five cubic feet of steam, at seventy-five pounds pressure to the square inch, weighs one pound avoirdupois.

STEEL TUBES MADE FROM SOLID RODS.—A curious way of making steel tubes from solid rods was communicated by Dr. Siemens to a recent meeting of the Akademie der Wissenschaft. A steel tube ten centimetres long (nearly four inches), with perfectly smooth external and internal surfaces, and extremely uniform bore, and whose walls are apparently of perfectly equal thickness at all points, was prepared in this manner: Two rollers, slightly conical in shape towards their lower ends are made to rotate in the same direction near each other; a red-hot cylinder of steel is then brought between these cylinders, and is at once seized by the rotating cones and is driven upwards. But the mass of steel does not emerge at the top as a solid, but in the form of the hollow steel tube which Dr. Siemens laid before the meeting. This striking and singular result was explained by Professor Nessen. It appears that, owing to the properties of the glowing steel, the rotating rollers seize only upon the outer layer of the steel cylinder and force this upward, while at the same time the central parts of the cylinder remain behind. The result is thus exactly the same as is observed in the process of making glass tubes out of glass rods.—*New York Evening Post.*

ROBERT MORRIS'S "FOLLY."—A gang of workmen were digging a cellar in the rear of 723 Sansom Street recently and destroying the lower walls of what was once the most notorious policy-shop and gambling-hell in this city. They came upon the massive foundations of the colonial mansion partly reared by the great financier of the Revolution, and known as Robert Morris's Folly. In 1798 the plot of land bounded at present by Chestnut and Sansom Streets on the north and south, and by Eighth and Seventh Streets on the west and east, was offered for sale, and Robert Morris became its purchaser at the cost of $50,000. To do this Mr. Morris disposed of other real estate on Market Street, which brought him $20,000. His ideas regarding the manner of house he desired were princely, and for those days somewhat extravagant. A French architect drew the plans and contracted to rear the building he had drawn on paper at a cost of $60,000. The extensive scale on which the mansion was laid out is shown by the fact that the cellars were divided into two stories, and that underground there was still room for a small army of servants before the first floor was laid. As the house grew, the architect's demands grew in proportion, and the estimated $60,000 became $80,000 before the third story was completed. Morris found himself unable to carry on the operations, and the house was sold at sheriff's sale. This was Robert Morris's Folly. Recently the foundations of the notorious 723 Sansom Street, where murder, faro and policy have all had their victims, were found to rest on the broad six-foot foundations laid by Robert Morris's extravagance.—*Philadelphia Press.*

MORE ABOUT THE LIGHTING OF THE VIENNA OPERA.—After a fortnight's experience the electric lighting of the Vienna Opera, at first criticised as defective, owing to some local jealousies, is now admitted to be a complete success, and Baron Beczny, director of the Imperial Court theatres, recently received the Grand Cross of the Francis Joseph Order in token of the Emperor's approbation. The success which has been attained here has a somewhat important bearing on the lighting of large public buildings in towns, as Mr. Monnier has solved the problem of supplying a perfectly steady and regular light to a theatre of such huge dimensions as the Grand Opera, one of the scenic requirements of which is, that lights equal to those ordinarily burning in sixty or eighty private houses may be suddenly put out or turned on without affecting the remaining lamps even in the smallest degree. Further, the generating machinery, which usually would require to be of 600 horse-power, and which it would, therefore, be impossible to place in, or even near, the building to be lighted, has in this case been established a mile away—a feat which nobody had previously attempted, or even considered possible. The difficulties indicated have made the construction of the machinery an exceptionally difficult work. The chief points which strike the spectator are the fixity and brilliancy of the lights in the auditorium, *foyer* and *loggia*, and the beauty and steadiness of the scenic effects. The changes in the intensity and steadiness of the lights can be made so slowly that lately, in the garden scene of "Faust," the gradual darkening of the stage extended over a period of twenty minutes, so as to be imperceptible to the audience—which is a great contrast to the jerky effects obtainable with gas, or even previously with electricity.—*London Times Vienna Correspondence.*

TRADE SURVEYS

EVERY indication on the surface of trade points to a continuance of the industrial and commercial activity which has made the present year a phenomenonal one in our history and as against one year ago, there is practically an increase of one hundred million dollars for business purposes. Should the law-makers perfect a fiscal system which would make the Government a less exacting tax-gatherer, it would remove one cause of apprehension from the mind of the public and help to strengthen confidence. There is no doubt but that practical statesmanship will be able to deal with this difficulty, which is exaggerated. The accumulation of large volumes of idle money is not only unnecessary, but, in many respects, harmful; yet it has its advantages in enabling the Government to throw its powerful arm around the business interests in the event of a general stringency. The only remedy in the estimation of the practical business man is a sufficient supply of money, but the question arises—what is that? Financiers know that it is possible at times, regardless of the abundance of money, to corner it, and they know that while the Government has in its possession a large amount of money with outstanding bonds, that no manipulation is possible, such as years ago overtook the commercial interests. The remembrance of those disasters will lead to at least an effort to establish a better and more elastic fiscal system. Revenue reform will be an important issue until it is settled upon a permanent basis, but as yet, politicians in both great parties are far from being a unit as to the best policy to adopt. The business interests have more to say in legislation now than they have had for years past. It is safe to say that their interests will be respected, and that whatever legislation is passed it will be based upon the practical business requirements of the country. The manufacturers everywhere are very busy. Prices are strong and are pointing upward rather than downward, but our best authorities East and West are free to say that another general advance in the prices of staple products will be made. It is the desire of the business interests of the country to avoid speculative business advance in any direction, and the policy they are pursuing and have been pursuing for a year make speculative views impossible. There is an absence of material of all kinds. There is a heavy demand for all kinds of manufactured products. Raw material, abundant as it is, is promptly absorbed for current requirements. The cotton crop is large, but is practically sold already. The wool clip will necessitate large importations. The petroleum supply is keeping pace with the market demands. Export trade in all leading products is heavy and is helping to keep the market price of all domestic products high. The petty industries are very promising. Thousands of little manufacturing establishments have sprung up during the past six months employing capital ranging from five thousand to fifty thousand dollars. These little industries have been planted in good spots and have every indication of permanency. The growth of corporations and of corporative power is an alarming subject to a good many, but if we measure this growth with the growth of little interests on a solid basis backed by sufficient capital and knowledge, we have less fear to entertain as to the possible effects of extending monopoly. The monopolies which exist are necessary in their time and place, without moralizing upon the question, we can say with safety that the monopolies against which so much complaint is being made are the legitimate products of conditions and surroundings. They will go as they come when their time comes. They are serving a good purpose, and will lay the foundation for a greater prosperity than that in which they found such good root. There are already indications of a departure from early wealth-producing methods. There are opportunities for men of small capital which did not exist a few years ago. The industries are being decentralized in such far-off States as Missouri, Iowa, Minnesota, and even in the Territories mining, manufacturing, and agricultural interests are gaining strength.

The condition of the great industries is about the same as two or three weeks ago. Rails, however, have declined one dollar per ton. Bar iron and merchant steel are fair in price. All kinds of crude iron hold their own. Ship and bridge building is being pushed very actively. Large orders have been placed during the past week at locomotive and car works. Several railroad companies are short of locomotive capacity, and all of the trunk lines are reported short of cars. There is great activity in the anthracite coal regions. The production this year is about 2,500,000 tons ahead of last year. A strike has been organized in the Lehigh region, but the deficit in consequence will not exceed perhaps 25,000 tons per week. The increased supply of bituminous which is available will probably compensate to a large extent for this deficiency. The builders all along the Atlantic Coast and along the Western slope of the Allegheny Mountains are crowded with orders, and complain of a scarcity of cars. Late advices from leading Western builders indicate that the coming winter will be one of greater activity in building than last year. Much work that was projected, but not undertaken, will be begun this winter. A large amount of capital is seeking employment in the far Northwest. The revival of interest in the Northern Pacific has opened a multitude of opportunities for capital which did not exist before. There is quite an opening for labor on the new lands recently thrown open by the Government. There is also great activity among the gold, silver, and lead miners of the West. The demand for machinery for improved mining methods has never been so great as at present. The mining-machinery manufactories in Chicago are oversold. Chain works, wire works, wire-fence factories, and a long list of manufactories (implement) East and West are in a better sold-up condition than October 1st last. Textile manufacturers of New England, as well as the boot-and-shoe makers are pretty well oversold. The makers of paper are in possession of a larger amount of business to be executed during the next three months that it has been their fortune to have at any one time heretofore. All of the industries throughout the New England States are doing very well.

The labor question is giving but little trouble, and there is a disposition among the workingmen to avoid radical measures, such as were so apparent a year or two ago. The various parties are familiarizing themselves with their work, and are endeavoring to create a friendly feeling wherever they are called upon to act. While labor is still organized it is not as much disposed to crowd employers as when struggling for organized institution. The Knights of Labor and the National Federation will probably agree to act in harmony, and one will be, to a large extent, an offset to the other.

The American Architect and Building News.

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CONTENTS

THE more detailed the accounts which we receive of the fire in the Exeter Theatre in England, the more deplorable appears the carelessness by which more than a hundred persons lost their lives. The building was a new one, the foundation having been laid only a little more than a year ago, and it was erected under the care and from the designs of an architect of great experience in planning such buildings. When the corner-stone was laid, the chairman of the company which owned the theatre made a speech, in which he said that "the real object" of the company was "to provide a theatre for Exeter of first-rate character, a place where they (the citizens) might go with a feeling of confidence and safety, and without being afraid of being roasted alive." We suppose that the chairman of the association of speculators thought it his duty to attract customers by alluring descriptions of the building, and left it to the architect to make his descriptions agree with the facts, and the architect, as usually happens in such cases, being brought face to face with incompatible requirements in regard to economy and safety, was probably obliged to conform to those which the chairman as a financier thought most important, rather than those which he had described to the admiring multitude in the halcyon time of laying the corner-stone. There was once a storage warehouse in New York, a tolerably flimsy affair, whose proprietor set up a sign in front of it bearing the words "Absolutely Fireproof." The building was soon crowded with goods, the owners of which, in many cases, thought it unnecessary to insure them, and, after bringing in fat profits to its managers for a time, it took fire and burned to the ground in a few hours, leaving its reassuring sign perched conspicuously over the ruins. In much the same way the Exeter Theatre, built "to provide a place where people need have no fear of being roasted alive," was provided with a weak proscenium wall, thinner, we believe, than the minimum allowed by law, and apparently built mainly to satisfy the inspector's hasty glance, and, in defiance of the rule accepted among architects for such cases, pierced with a door leading from the gallery to the stage side of the wall. The facilities thus provided for distributing fire from the stage over the auditorium were supplemented by an admirable arrangement for preventing the people in the upper part of the house from getting out in case of a conflagration. The gallery was seated for three hundred and fifty persons, and one door, five feet wide, was planned for all of them to get out of while the flames were rolling toward them! On the night of the fire the gallery was occupied by one hundred and ninety-one persons, of whom something like one-half managed to get out, although some of these were bruised and mangled to death in trying to run down the single tortuous staircase leading to the ground. It must be understood that we do not blame Mr. Phipps, the architect, for all these faults. He was, undoubtedly, compelled to yield his convictions to the requirements of economy and the routine of theatrical management, but we think it is quite time that theatrical management should be inquired into to see whether those of its principles which are incompatible with safety to audiences cannot be modified. It will be a hard matter, we imagine, to persuade lessees that the multiplicity of entrances, through which safety is most certainly secured, can be provided without greatly increasing their expenses for ticket-takers and guards, and the architects of theatres seem generally to have abandoned the attempt, confining their efforts to the provision of sprinklers, iron curtains, and other feeble safeguards on the stage. Now, however, the comparative uselessness of all these has been abundantly demonstrated, and the devices intended as improvements on these, such as scenery painted on wire gauze, asbestos curtains, and so on, are so costly that managers, who have already begun to grumble at the outlay necessary for modern stage fittings, are likely to rebel entirely if any more is laid upon them, so that a recurrence to the many-exit plan will probably be the next step. Properly managed, this is by far the cheapest and best solution of the problem, adding nothing to the cost of the theatre, and insuring the safety of the audience under all circumstances, even though the scenery, the curtains, and the decorations of the auditorium should be of cotton cloth. If the difficulty about controlling so many doors could be overcome, this would be the essence, as we think, of future theatre-construction, and the control of the doors is a problem of planning which architects are quite capable of studying and solving if they could once have the matter, from the manager's point of view, clearly explained to them.

MR. A. W. FULLER, the expert adviser in the New York school-house competition, which we discussed last week, writes us that, fortified by our remarks, he has been able to induce the State Superintendent of Public Instruction to open this competition to architects in any part of the country, and that, consequently, the date of closing the competition has been postponed to December 15 next. We regret that we did not know that the official head of the department was so ready to accept reasonable suggestions, as in that case we might have laid more stress on the desirability of making the prizes offered more commensurate with the work they are intended to reward.

THOSE who remember a few articles on "Urban Housing," published in the *American Architect* in 1878 and 1879, and can recall how well reasoned and practicable was the arrangement of houses upon the city lot prescribed in New York therein described, will be interested to know that the writer, Mr. Edward T. Potter, has continued his studies in a serious vein ever since, and has devised other arrangements than those previously described, which we are persuaded could be adopted in New York and elsewhere, with advantage to the general sanitary welfare of the citizens. Amongst our illustrations this week will be found a diagram which explains with clearness how Mr. Potter would arrange streets and houses so as to secure for them the greatest amount of the all-necessary sunshine and circulation of air: it is ingenious enough to deserve careful study at the hands of both architects and real estate owners.

TWO more illustrations of the way in which the French law looks at certain common questions are given in *La Semaine des Constructeurs.* The first case resembles one described by a correspondent in these columns not long ago. A certain proprietor requested an architect to make him plans and elevations, with a specification, for a house in the country. He told the architect what rooms he wanted, and how he wished them arranged, and when the plans were done he appeared to be pleased with them. When the estimates came in, however, they were found to exceed by a few hundred dollars the sum which he wished to expend. The architect left the papers and drawings in the proprietor's possession, but heard nothing further from him until he received a polite note, conveying thanks for his trouble in making the drawings, and informing him that another architect had appeared upon the scene, who had succeeded in getting what was wanted for a smaller sum, and that the building had just been finished from the latter's plans. The victim of the transaction, finding that nothing was said about paying him, then inquired whether he could collect proper compensation by process of law, and how much the compensation would be. To this inquiry the law-editor of *La Semaine* replies, saying that an architect who, at the request of another person, prepares plans and specifications, is

unquestionably entitled to be paid for doing so, whether his plans are executed or not. What should be the proper compensation to the architect in such a case would be a question, as we should say, for the jury. If the architect had been engaged for full professional service, there can be no doubt that he would be entitled to recover the full value of his contract, that is, the net profit above expenses which he would have received if he had carried the work through to completion; but where one had been simply engaged to make plans and specifications sufficient for estimate, it is not so easy to determine how much his trouble would be worth. A decree of the Court of Paris in 1844 fixed the proper compensation in such cases at one-sixtieth of the estimated cost of the building, or about one and-seven-tenths per cent. This seems to have been intended as a liberal interpretation of the value of the architect's services, as the correspondent of *La Semaine* only mentions one and one-half per cent as his idea of the proper amount of his bill, but the case may have seemed to demand such liberality.

THE second case, as treated by *La Semaine*, introduces a principle of law governing the rights of abuttors on public streets which is of considerable importance. Another correspondent is interested in a house which projects beyond those on either side of it so much that the sidewalk is nearly intercepted by it. The street is narrow, and the authorities propose to enlarge the roadway at the expense of the sidewalk, making the latter so narrow that none of it will be left in front of the house in question. The occupants of the house naturally do not like to step from their front door into the roadway, and they wish to know whether the city has a right to cut off their sidewalk. The answer of *La Semaine* contains very little comfort for them. The ground devoted to streets, it says, is inalienable and imprescriptible. No person can acquire any rights over it, and any encroachment or projection which may be tolerated, or even authorized, exists only on the condition that it may be suppressed at any moment by the same authority which once permitted it. This doctrine might be made a source of decided inconvenience to the dwellers in cities in this country, who enjoy all sorts of privileges in the shape of areas, hatchways, bays, porches and oriels projecting over the street line which are unknown in the formal French towns, but it may be that our common law would look at the matter differently.

WE have another curious French case, which we find described in the August *Bulletin* of the Société Centrale des Architectes. Here the question was whether the certificate of an architect is so usual a preliminary to payment to a builder under a contract that it is to be legally considered as implied in the contract if nothing is said about it. A certain Madame de Prandières had her château remodelled under the direction of an architect. A mason's bill was brought in for thirty-seven hundred dollars. The architect refused to certify it, and demanded that it should be reduced to twenty-six hundred, which he regarded as the proper sum; and the masons pursued him with protestations and claims for the full amount of the bill. Meanwhile, Mme. de Prandières came from Lyons to see the work, and the masons presented their bill to her; and she, being inexperienced in business, and supposing that the account was correct, paid it in full. On discovering the mistake, she demanded its correction, which the masons resisted, on the ground that an account once settled by agreement of both parties could not be reopened. The court, however, held that the account was not settled, since it had not received the approval of the architect, and it could not be supposed that Mme. de Prandières would have intentionally paid so large a bill if she had known that the architect had refused to certify it. Moreover, under the custom that a contractor's account must be approved by the architect before payment, the portion not approved by the architect was not, under the contract, due, and any person paying money not due was entitled to receive it back, whatever might be the formality with which it was paid, so that the lady had the right, if she wished, to demand the restitution of the whole sum paid beyond the amount certified by the architect. In point of fact, she asked only for the appointment of referees, to determine the exact amount due, and return her the balance, and the court ordered that this should be done forthwith.

THE *Builder* says that the Italian Government has appropriated the necessary funds for excavating the ruins of Sybaris, perhaps the most interesting locality in all Italy. When we reflect what treasures of art have been derived from Pompeii, a poor little village inhabited by people of Greek descent, it may be imagined how vast must be the stores of similar objects which were anciently accumulated in Sybaris, the richest of all the Greek colonies in Southern Italy, and at one time the central point of a community of busy farmers and artificers numbering three or four millions. Every one has heard of the luxury and extravagance of the Sybarites; how they slept on couches of rose petals, and forbade any noisy trade to be practised in their city, lest their nerves should be disturbed; and during the twenty-five hundred years that have elapsed since the conquest and destruction of the town, its treasures, instead of being gradually scattered, have rested securely under the alluvium of the River Crathis, the course of which was turned by the victors, expressly that its mud might cover the dwelling-place of their enemies. It is true that the assailants, the citizens of the neighboring city of Crotona, undoubtedly carried off all the most valuable objects that they could find, but some of the most precious ones were probably hidden out of their sight, and myriads of bulky articles, which were valueless to them, but to us are precious objects of art, and documents of archæology, must remain. The site of the town is well known and convenient, being close to the railway station of Buffalonia, near the Gulf of Tarentum, but the climate is so malarious that no attempt has been made, in modern times, to excavate it.

THE *Bautechnische Zeitung* gives some practical suggestions in regard to the use of ropes which may be worth remembering. With hemp ropes the character and probable strength may be judged in some degree from the appearance. A good hemp rope is hard, but pliant, yellowish or greenish gray in color, with a certain silvery or pearly lustre. A dark or blackish color indicates that the hemp has suffered from fermentation in the process of curing, and brown spots show that the rope was spun while the fibres were damp, and is consequently weak and soft in those places. Sometimes a rope is made with inferior hemp on the inside, covered with yarns of good material, but this fraud can be detected by dissecting a portion of the rope, or, in practised hands, by its behavior in use. Other inferior ropes are made with short fibres, or with strands of unequal strength, or unevenly spun. In the first case the rope appears woolly, from the number of ends of fibres projecting, and in the latter, the irregularity of manufacture can be seen by inspection. Occasionally, a hemp rope is spun with a core or central strand, such as is used in the interior of many wire ropes. This somewhat increases the strength, but the core, shut in by the outside strands, is liable to rot and infect the rest, and any rope with a musty, mouldy smell should be rejected. The best hemp comes from Russia, Switzerland, Alsace and Northern Italy, and it is said that the strongest fibres are obtained from plants grown at the foot of high mountains. Ropes to be used on board ship, or where they are liable to be often wet, are usually soaked in tar to preserve them, but the tarring diminishes the strength by about one-third, and increases the friction of the rope. The injurious action of tar upon the hemp fibres seems not to be clearly explained, but it is said to be lessened by subjecting the tar, before applying it to the rope, to repeated melting and washing with water. The effect on a rope of soaking with water is, however, worse than that of saturating with tar. According to accurate experiments, the tensile strength of a wet rope is only about one-third that of the same rope in a dry condition, and a rope treated with grease or soap is weaker still, apparently through the influence of the lubricant in facilitating the slipping of the fibres. It should never be forgotten that hemp cords contract strongly on being wet, a dry rope twenty-five feet long shortening to twenty-four feet or less when dipped in water or exposed to heavy rain. Every one remembers the story of the raising of the obelisk in Rome, when proclamation had been made that any one who spoke during the critical operation should suffer death, and how, when the obelisk had been raised nearly to its place, and the hoisting-cables had begun to stretch and threatened to let the stone fall, a bystander shouted, "Wet the ropes," and his advice was taken, and the obelisk drawn safely into place by the contraction of the fibres while the author of the suggestion was being dragged away to execution; and apocryphal as the tale probably is, it may have had a certain foundation in some opportune use of a property of hemp cordage which often causes loss and annoyance to builders who leave tightly-stretched ropes exposed to rain or dew.

A DAY IN OTTAWA.



SEEN by such light as a midnight sky in northern latitudes affords, Ottawa seemed to promise more entertainment than Montreal. The half-seen outlines of buildings on either hand suggested that daylight would show that the commonplace of every day had been left behind, and that at last something typical of the country and the people would be discovered in the morning. As the tired little hack-horse — successor to one the driver had done to death during the day in his endeavor to reap a profit out of the exhibition then holding just outside the town — turned a corner under what seemed to be a beetling fortification, the occupants of the back seat agreed that this little side-trip looked uncommonly promising. The supposed fortification seen by daylight proved to be merely a cliff some forty feet high, but even then it was much more picturesque than the mere wall of masonry that would have been found if the first impression of its martial character had been well founded. At any rate, its dusky outline served to give tone to the entrance into town and allowed the travellers to seek their rest with pleasurable anticipations of what was before them, after first having made sure of where the hotel stairs were, and discovered that the window looked onto some kind of back premises, which did not offer any promise of practicable escape in that direction in case of fire. This precaution is evidently one that visitors to Ottawa will do well to observe, for a few days later two of the hotels in the city were burned; but as the hotel in question still stands, the sensation of having narrowly escaped disaster cannot be added to the experiences of the trip.

If the Dominion of Canada has a flag of its own, it must be that that caught the eye of the just-awakened visitor as he slowly came to his bearings and wondered whether the day were fair or foul: a red flag with the union jack in the usual corner and in the field of the flag a small square patch bearing a scutcheon of some kind, but although the city abounded in flags in honor of the exhibition, it was not possible to determine with accuracy what the character of the design was. Apropos of flags, amongst all the fluttering bunting, not a single tri-color was to be seen, except over the door of a little wooden mission chapel where three strips of faded calico stood for the emblem which, one would think, must still be dear to those of French descent.

The first look about the town showed it to be a rather straggling place laid out on no very evident plan, except so far as it was apparently the intention to get as much benefit and enjoyment as possible from the beautiful situation selected for it on the banks of the Ottawa. It has not a little the air of a frontier town — and with good reason, for such it is, the great uncultivated wilderness lying not far to the north of it — just passing through its first period of municipal growth: the precise degree of development it has reached may be typified, perhaps, by the fact that, while it has horse-cars, the streets are unpaved. The few commercial buildings were uninteresting and characterless enough, and seemed to be such only as were needed to supply the daily needs of the inhabitants. There was little to be seen that suggested the presence of manufactures of any kind or anything like an export trade, except in lumber. This is the main interest of the place, and the huge piles of sawed lumber spread over acres and acres of ground about the Chaudière Falls make it seem impossible that a use can be found for so much wood, or that the forests can stand the drain upon them. How great an industry this is, is indicated by the report that our consul at Ottawa has just made in response to the instructions from Washington — which may have bearing on the matter of commercial union between Canada and the United States, or, just as well, upon the desirability of instituting at some time retaliatory measures to offset what are colloquially styled the fisheries outrages. From this report it appears that Ottawa exported into the United States $3,000,000 worth of dressed lumber during the last fiscal year; and the magnitude of the industry may be guessed from this fact, and the further fact that, so far as could be seen, the abstraction of so large an amount of wood did not appear to have any overwhelming effect on the stock in the lumber-yards. It was impossible to look on these vast stacks of lumber, through which ran covered passageways seemingly half a mile long, without thinking what a jovial bon-fire they would make; and it is more than likely that the possibility of such a fire may have been grimly present of late to the minds of the mill-men, surrounded as Ottawa has been for the passed few days by forest fires utterly beyond control, fires which have packed the river valleys with smoke so thick as to put a stop to river navigation, and have sent the dusky haze as far even as Boston, with such density as to make it impossible for photographers to do their work while it lasted.

Right athwart the town passes the Rideau Canal, and between the main street and the Ottawa River is a group of eight or ten locks whose filling and emptying are a constant source of interest to the idlers on the bridge which passes over the first one of the group. Lying just below this bridge, moored to the canal wall, was an aquatic caravan which had a most tantalizing air to any one who had any interest in out-door life and amusements — a little eighteen-foot steam launch, presumably moved by a naphtha-engine, and a companion boat in tow, with a deck-house filling its entire area, which was evidently provided with berths for two or three voyagers, and a galley. On the roof were lashed a canoe and the necessary paddles and spritsail rigging, with landing-nets, gaff-hooks and the other paraphernalia of the well-equipped sportsman. The whole outfit suggested that in the case of the boat's owner much of the hardship as well as some of the romance of camping-out had been minimized.

The canal just below the locks empties into the river, and upon either side of it rise picturesque and well-wooded cliffs, along the crown of one of which is laid out a pretty little public park which, in the general view, makes a good foreground to the cathedral beyond; while upon the plateau upon the opposite side of the gorge are laid out the grounds of the Houses of Parliament of the Dominion of Canada, the chief feature of interest in the city, and the particular pride of the entire country.

It would be hard indeed to find a better site for a group of public buildings. The river is broad enough, when full, for the marine [if the word is allowable] element in the landscape to have considerable effect, and the abrupt and rocky banks, though well wooded, fall away so as to give a broad pyramidal base to the group. No fault can be found with the grouping of the buildings; they compose well, as regards one another, from every point of view, and the observer is not consciously irritated by their presence in the midst of the fair surroundings. The landscaping is singularly successful — broad, generous, and judicious. In the photographs and published views this is lost sight of because no lens can compete in width of angle with the human eye, and from any point of view it is not possible to get a photograph of the group that will do the arrangement justice. If the individual buildings were as good architecturally as the landscaping of the group it would form a well-attended shrine for American as well as Canadian tourists. Unfortunately they are not, and just at present they are at a disadvantage, as they are not in the architectural fashion of the day. Victorian-Gothic seems a long way behind us nowadays, and the unfinished Patent Office on the opposite side of the street, with its full-centered arches and general air of robustness is much more restful and satisfying than its older and more audacious neighbor with its over-elaboration of Gothic detail. Moreover, it is built of a more agreeable material, a sandstone of a strong greenish tinge which in mass has considerable warmth to it. In the Houses of Parliament, on the other hand, a not too-successful attempt at polychromatic treatment has been made. The principal material used is a sandstone — a much more interesting material than that found about Montreal — in which are considerable traces of iron which, when the work was fresh, may have given an agreeable tone to the whole, but now are in too strong contrast with the mass of the material, the surface of which has weathered to a dirty chalky-looking substance. Moreover, in some of the older buildings of the group, here and there, are pieces of stone cut from strata impregnated with oil and this has oozed out and stained a sooty black the stones in its vicinity. The generally unsatisfactory coloring of the buildings is heightened by the color of the sandstone used for the voussoirs and some of the other wrought-stone finish: this is of quite a salmon-colored tone, and like everything about the stonework looks faded. The polychromatic endeavor reaches its greatest exaltation in the finials and crestings which are painted a brilliant ultramarine which, in places, as in the Victoria Tower, has washed off and stained the stonework of the roof below, so that this has quite the air of having been taken unrinsed from Monday's wash-tub. Feeling the need of keeping this vagary in countenance, some one has given the few outside blinds, which the convenience of the occupants has made it necessary to apply to windows here and there, vigorous coats of the same unusual color.

While the grouping is excellent and much of the detail good the unit of design is unqualifiedly bad, and in reaching this conclusion the observer is hardly influenced by the fact that Gothic work is just at present so out of fashion, for even when the revival was all the rage, the lancet window, which singly or in groups forms the key-note of the design, could never have been considered a well-proportioned feature. As compared with the height, the width is not too great, but the arch springs from a point apparently less than half-way up, the result being that the effect of verticality is lost, and the feature appears to be all arch — and arch of a very ungraceful form.

In one other particular the designer has missed his way: the Victoria Tower, which forms the chief feature of the Parliament Building proper, is in every way too small for its intended purpose, and from every point of view, except from a position on the main axis of the building, seems to be contending — and altogether unsuccessfully — with the library in the rear for the dominance of the group. Either the inspiration of the designer had spent itself, or the appropriation was too small when this feature was reached, for in some way a story or two seems to have been left out either at top or bottom, and the crown at the top seems meagre, perhaps intentionally symbolizing the waning respect for crowns that Canadians are nowadays suspected of entertaining. Seen from the rear the four ventilating towers, extremely good features in themselves, have each about as much importance as the Victoria Tower.

From most points of view the library is the dominating feature, and a very little variation in proportions and treatment would have made it so, and to the great advantage of the group. Even taken by itself this building would have gained by having a higher base or a more lofty main story. It is, nevertheless, a better and more interesting building in execution than photographs and prints would lead one to expect: it is quite large enough to lose some of that confectionery air that is so apparent in the published views.

As for the interior there seems to be, as is usual with such buildings, the maximum of husk to the minimum of kernel. The two legislative chambers are neither large nor imposing, but they are well lighted and airy apartments. The feature of the interior is the library which is rather interesting, though it looks hardly as if it were really meant for use, and as there seemed to be very little shelf-room unoccupied, it is not easy to see how the accumulations of future years are to be accommodated, for the plan of the building is peculiarly ill-adapted to expansion and alteration. The shelves are ranged along the walls of the sixteen-sided chamber, around which run the galleries. Alcoves are formed by short book-stacks projecting from the walls toward the centre of the room, and as these radiate shelves are of not too great depth the arrangement is a very decorative one, and distinctly helps the general effect of the whole room. As the library is extremely well lighted there seems to be no real reason for making the floors of galleries and alcoves of flooring glass, but the presence of this material is only an evidence of the thought and care bestowed on the work by the architect. The woodwork is white pine, finished in the natural color, and before the color darkened the effect must have been airy and pleasing, and the coarseness and obtrusiveness of the wood carvings must have been at that time much less noticeable than now. These carvings are the only really objectionable feature in the room; they shout for attention as soon as the door is open; *rinceaux* sprawl and wriggle at you, and cabbage-like flowers put on their broadest smile and try to lure you from point to point. Everywhere in the hand-carving is coarseness, excess and exaggeration. Nevertheless, the impression the room leaves on the mind, like that produced by the entire group of buildings, is very pleasant.

On the other side of the Rideau Canal just beyond the little public park rise the two open-work (hardly tracery) spires of the Cathedral of Nôtre Dame which make a very interesting point in the landscape by reason of the soft gleaming of the unpainted tin which protects them. The dry air of Canada makes it unnecessary to paint tin roofs, and the slow tarnishing of the bright surface eventually produces an effect which is far superior to anything which gilding can produce.

Aside from the Chaudière Falls just on the outskirts of the city, and forming part of the landscape seen from the Parliament grounds, there is little else to induce the visitor to wander far from this part of the city.

PROFESSOR T. HAYTER LEWIS ON THE LAYING OUT OF TOWN AREAS.[1]



In availing myself of the privilege of addressing the members of this Congress in this active and stirring town, which is spreading itself out in every direction, I have thought it well to bring before them a subject of great interest, but which has not been hitherto much discussed, viz., the extension of our great cities and the erection of new ones; and to suggest such a course as would ensure that such requirements as are now considered to be necessary for their healthful occupation may be provided for at the outset.

Of the conditions to be noted in selecting a site for a new city, we have descriptions by writers of all ages, from Vitruvius in the first century to Dr. Parkes in his well-known work of our own time. But this is a subject too large for a short address, and it is of the extensions only that I wish now to speak. They have, almost invariably, been carried out by speculators without any general definite guiding plan, with little or no forethought for future extension, and with slight provision for supplying the inevitable future wants of the inhabitants. Thus, in the course of time, spaces have to be cleared out for churches, schools, institutes, baths, and such like edifices as are now required for a large population, and clearances have to be made to allow for its free breathing. The extension of the cities takes place in different directions and from different motives.

The well-to-do citizens leave their smoky town and confined houses to form new suburbs, where they may breathe freely in their open gardens.

The artisans cluster together at first for cheapness and for nearness to their work. Then comes over-crowding and then Sanitary Acts, and then suddenly the neighboring fields are invaded, and acres of ground are covered with new small houses, put up as a speculation in the cheapest way, with just so much breathing-space as the local by-laws (if there be any) will allow.

Now, if this be the time of activity in building new towns and extending old ones, it is also preëminently the time of activity and power in corporate bodies. From Town Councils to Vestries, from Trade Guilds to Trade Unions, from companies formed for their own benefit and companies formed (all honor be to them) for the benefit of their fellow-citizens — an active part is being taken in public work.

New and extensive powers are being acquired and exercised by corporations for the sewage, the supply of water and of gas, for providing open spaces, regulating the width of streets, and even the height of rooms and size of windows. Your own by-laws are sufficient evidence of this.

Now I simply wish to extend these powers. I wish that when it may appear evident to a Corporation that any district will require before long a large accession of houses for a population which is clearly increasing to an overflow, such corporation shall have the powers (and I think that public opinion will require it to exercise them) to acquire control over the requisite land — to formulate a general plan, giving the width and direction of the streets — to provide spaces for such public buildings as are certain to be required in a well-regulated community, and for such open spaces as are required for its healthy enjoyment.

My scheme is not a very grand one in any respect; I simply want to provide at first for those requirements which must eventually be provided, which can only be fulfilled at a great cost, and even then imperfectly, if not so provided at first. I do not even suggest that the Corporation should build, but that it should give general guiding directions, leaving the working-out to private persons, or to such companies as have of late done so much good in building dwellings of various classes, from the highest to the lowest.

To show that such powers as I have indicated might well be called into being on behalf of even a high-class district, I might have brought before you the earnest attempt made, some thirty-five years ago,[2] by the late Professor Cockerell, R.A., to obtain a public control over the proposed buildings at Hampstead, a suburb now covered with houses.

As I was reminded by my friend, Mr. Rogers Field, the Professor drew out a design by which the whole of that suburb might have been built over on one definite plan, utilizing the various hills and valleys, so as to take every advantage of its picturesque beauties. Public opinion was not ripe for such a course then, and this grand opportunity was lost.

[Professor Lewis then described, with the aid of a map, a district of London, and the mistakes made in laying it out, and proceeded to point out in detail on another map the manner in which the same district might have been laid out, by forethought, so as to accommodate the same number of persons with more convenience for traffic and with greater attention to provision for healthful and enjoyable life. The details of Professor Lewis's remarks, however, can hardly be intelligibly followed apart from the diagrams, and we proceed to the more general remarks arising out of the subject.]

I now ask you to bear with me whilst I enter, in some detail, as to the public works and buildings for such provision should be made. I assume that, as a matter of course, the sewers, water and gas supplied, will be provided in the usual way, so I need not detain you as to these.

In the first place, I would set aside a strip of land outside the whole district for the park, which I take for granted would ultimately be required, no matter what the rank of the adjoining houses may be. Its distance from the farthest point would be about that suggested by Mr. Besant, viz., half to three-quarters of a mile. The size which I suggest here is about the same as that of the Hesketh Park at Southport, which is in one of the best parts of the town, and much smaller than the one here. The position of this open space would provide well, also, for the future extension of the town, and would afford the advantages obtained in the same way as, *e. g.*, at Hastings, where the pretty St. Andrew's Gardens, starting from the old town, pass round at the back of the houses, and are continued to St. Leonards, making an admirable belt of free open air and foliage. Neither in this case, nor in that of public buildings, do I propose the work to be undertaken at the first, but only so to arrange, at the first, that the sites shall be so reserved as to be available when required. As to these, I need do no more than mention offices for the local authorities, and the library, reading-room, science and art schools, and other buildings required for the particular locality.

In the arrangement of these public buildings it would be difficult to take a better example than that of Southport, whose Lord Street and Albert Road form one of the prettiest vistas that I know (I trust that Brikdale will pardon me for classing it with its neighbor) — and I use the word "prettiest" advisedly, as I could not, of course, compare it with such grand thoroughfares, each unrivalled in its way, as the High Street of Oxford, or Princes Street at Edinburgh.

[1] From the address given by Professor T. Hayter Lewis, F.R.I.B.A., as President of Section II, Engineering and Architecture, at the Bolton Congress of the Sanitary Institute.

[2] *Vide Builder*, vol. xi. (1853), p. 417.

At Southport the chief public buildings are located behind a group of trees, and I know of few more pleasing views than that of the spires and turrets of Christ Church, the Presbyterian Church, and the municipal and other buildings, towering above the foliage, whilst between the trees the buildings themselves are picturesquely seen.

Outside the park I should place the infirmary and convalescent home, a position in which they would have free light and air. If any one suggests that such a position would be too public, and lessen the enjoyment of the park, I would refer him to your own infirmary and children's hospital (the latter the gift, I believe, of your own townsmen, Dr. Chadwick, and his family), and ask him whether, as a simple matter of landscape effect, to say nothing of the value of such an outlook to the patients, he would wish this picturesque building, designed by one of your able townsmen, Mr. Knill Freeman, to be removed. Or, again, think of the charming way, and without the slightest feeling of sadness, in which the promenade at Southport ends with such a building, whilst at two such different places as Manchester and Hastings the Infirmary forms one of their most prominent buildings. Next to your noble Town-Hall and the old churches, the most prominent building is, I think, the market. I do not, of course, propose any such grand building as yours for my district. It might be open at the sides, but covered, as at Preston and Blackpool, or be enclosed as here and at Southport, or St. John's at Blackpool. I know that many towns of importance (I may, I think, name Norwich and Cambridge amongst them) have still little more than open and uncovered market-places, healthy-looking and pretty, with fruit and flowers and vegetables, on a fine day; but we often have quite other days in our country, and the attempts at covering up and protecting the stalls then turns the market-place into a wretched collection of tumble-down huts — I had almost said as bad as Fleetwood. If the quarter be chiefly for artisans, public wash-houses will be indispensable, and, in any case, no matter what the class of inhabitants may be, I look upon public ba hs also as a provision which can scarcely be valued too highly. For these baths and wash-houses I have suggested no definite site, as this would depend so very much on the kind of inhabitants.

Nor have I marked out definitely sites for churches, chapels or schools. All these are provided for in the district as it exists, and sites would undoubtedly be claimed for and provided, whatever the general plan might be.

I come now to some other details, as to which I may not possibly have your assent. First, as to drinking-fountains. That such small ones as are now commonly seen should be provided, you will doubtless quite approve. There are many excellent examples in most of the towns in these parts, each combining a drinking-fountain with a public lamp, and being really an ornament to the streets. But I want something more than these, as much for the sake of health as for ornaments to the town.

You know well enough that all the water in use for your houses is stored in cisterns; and although in past times these cisterns were looked upon as being worthy to be seen, and so were ornamented in a way which is now the envy and admiration of workmen and artists alike, they are now rough ugly things, stored away out of sight in any convenient closet or loft which will hold them, and for all their owners know of them may be considered as the property of the spiders. You depend upon your plumber to clean them out once a year. Perhaps he does; perhaps he does n't. You are none the wiser. But imagine what often happens in the houses of a poorer class. I need not go into details, but I say that a good supply of water, pure for drinking, is an element of health which ought to be provided, and that you cannot provide it in a better way than by fountains. These, in what are now called "the Dark Ages," formed some of the chief ornaments of a town, and I see no reason why they should not do so now.

I don't want to bring in such vast bodies of water as were brought through miles of aqueducts into Rome, or such lavish displays as you have seen in Paris, or even such things as our fountains in Trafalgar Square. Nearly all these send their waters into the drains.

There are fountains even now in most of our towns, — a very elegant one at Southport, for example; but, again, with all the water running to waste; whereas in some of the most picturesque Mediæval examples, it came out in small useful jets, as I would have them here; and I feel no doubt that, by a skilful arrangement of gas-jets, the effects of frost might be prevented, and a great boon thus conferred in winter, on rich and poor alike; whilst, by a skilful design, they could be some of the most pleasing ornaments to the town that could be conceived. And, as part of the water must go to waste, send it to feed a small stream in the park, like the one here or at Hastings.

Another accessory I must mention is that of seats placed at intervals between the trees. I shall, no doubt, have the same objection made to them as to the trees, and my answer would be the same.

Then, to complete my plan, I would have a small open space opposite to each railway station. Now we have to see, before entering into the question of the kind of houses to be provided, how much the plans which I have suggested have trespassed upon the space now occupied.

I have laid out my main roads in very much the same general direction as the present ones, though in less circuitous lines; but I have made them sixty feet wide instead of forty feet, and have set apart spaces for public buildings, etc. The smaller streets I have made forty feet wide, the width required by the Model By-laws being thirty six feet. The space which I have assigned to the park need not be taken into our calculation, as it is altogether outside that now built on; and I think you will readily see that the great waste of space necessitated by the irregular plan of the district, as now actually existing, would allow to a very great extent, if not altogether, for the extra space which the suggested re-arrangement would require.

As to the general arrangements of the streets and houses, I will call your attention to some methods, unusual to us, with which one meets abroad. I omit any notice of the large many-storied houses which are familiar to you on the Continent, and I shall take, as examples, one of the northern towns in Europe, Hamburg, and one of the southern ones, Naples. Several years since, I was commissioned to make a detailed report on the former town, for one of the principal insurance offices (the Union) of London, and I was thus led to see more of it than, perhaps, most of the people who visit it. The arrangement is peculiar. The main streets are wide, and give to a casual passer-by scarcely any indication of their affording access to any other streets. But a nearer inspection shows numerous doorways, so low and narrow that they appear to lead only into cellars, and through which you have often to descend by steps, and these lead into the streets behind, locally named *hofs*, which we should call alleys, and which are, of course, completely closed against ventilation from the main street. They vary from twenty feet to as little as five feet in width, the houses in the wider streets overhanging on each side and being densely populated. They usually abut on canals, and when these are dry the result in hot weather may be imagined. This arrangement, intended, no doubt, to bring different classes of people together, reminds one of the Wynds of Edinburgh, but with all their evils intensified, and a worse result could scarcely be imagined. Very many of these have been demolished, but a large number still remain.

I take you down now to the sunny south at Naples, where the same attempt has been made. It is not in my province now to describe the ordinary houses there — of the horrors of which Signor Gallenga and Mrs. Oliphant have given most vivid descriptions — but only the particular class to which I have alluded, and which may be seen to perfection in the drive through Portici. The streets throughout are wide, and lined for the greater part of their length with frames of macaroni hung out to dry, and many here will no doubt well remember both the sight and the smell. The houses on each side are several stories high, the first floors (*piani nobili*) having wide balconies, and altogether having a cheerful look and being tenanted by well-to-do and often wealthy people, whose apartments are entered from an internal court approached from the street by a lofty carriage gateway, through which one has lovely glimpses of beautiful gardens sloping down to the Bay of Naples. But the lower stories throughout, close on the ground, are tenanted by humbler classes, their rooms entered from the street. Here, again, we meet with an attempt to combine the classes, and thus to prevent one neighborhood being given up to the poor and another to the rich.

But again this fails. The lower rooms have no windows or other openings at the back, and derive the whole of their light and air from the street. The state of the inner rooms, usually parted off by a curtain as sleeping apartments, in the heat of an Italian summer may be imagined; and these rooms are not inadequately described by Mrs. Oliphant as "dark caverns with one vast door, giving all the light that can penetrate." Were it not that the people live almost entirely in the open air, they must be decimated. The same arrangement will be found in most other Italian towns, but in them there is, usually, some opening, however small, at the back.

Something of the same kind would appear to be adopted, judging from the plan only, in a flourishing town in our own country, — viz., Great Yarmouth, the arrangement of which is very peculiar, and unlike that of any other English town with which I am acquainted. I show a drawing of this, enlarged from one which was kindly drawn for me by Mr. Arthur Hewitt, an architect in the town, who has supplemented the Ordnance Map by many important details. The main streets are wide and well ventilated, and lined with good houses (mostly shops) several stories high; and running between these streets at intervals of about forty-five feet are long narrow alleys, termed rows, out of which lead houses of an inferior class. Looking at the plan only, this would seem to be no better than Hamburg; but in reality it is vastly better. The entrances are open for their whole height to a wide street at each end, or to the spacious quay; the alleys are cleanly kept and well paved, the houses in them are low, so as to intercept the light and air very slightly, and each has a small court attached to it; and the whole arrangement, so far as I can ascertain, is not prejudicial to health. Nevertheless, the narrowness of the streets does, no doubt, to some extent, clash with the golden rule which Dr. Richardson put very strongly in his well-known lecture at Croydon (1879): "Make the sun your fellow-workman," which is much the same as the Italian proverb, "Where the sun does not enter the doctor does."

Now, in remodelling our district, what system shall we adopt as to the houses? The first question is as to their number of stories. This subject is a serious one, for hundreds of acres near our towns are now being covered with two-storied dwellings, clustered close together in populous neighborhoods, or semi-detached when more in the suburbs. As to this, I do not wish to lengthen my paper by going into any argument, but I must briefly allude to some of the leading facts. The governing idea in respect of the self-contained houses of two stories is, of course, that of privacy, or, in the better

class of houses, the absence of stairs; but in many of our new London squares one large open space, garden, or yard (according to the class of house) is common to all; and the separate houses are being largely superseded by the dwellings in flats. At the first sight the two-storied houses would appear to have the recommendation of ensuring a less dense population than in the many-storied ones; but I wish to consider the subject on the basis of the same number of inhabitants in each case, the area gained by the extra stories being appropriated to open spaces in the way of yards or gardens, so that no question as to the bearing of the density of the population upon their health will rise here.

In considering the relative merits of the different styles of houses, the first fact which presents itself is, that with those of two stories only, the whole of their inhabitants must live and sleep either immediately over the ground or directly under the roofs.

I need scarcely say that the nearer to the earth the ground-floor is the cheaper it is to build, as less height of wall is required; and the consequence is that the floor is raised a few inches only above the street level, and the occupant has only that space between him and the earth. The rest of the inhabitants must live and sleep directly under the roof, — not a very pleasant experience even in well-built houses, whether through the heat of summer or cold of winter; and very many here, doubtless, know what is the case where the house is run up cheaply merely to sell. In point of economy of building, and of course of rent, it must be borne in mind that, though the thickness of the lower walls must be somewhat greater in a high house than a low one, one roof will cover, and one foundation hold up, four or more stories, as well as they will cover and hold up two.

As to the general feelings with respect to the subject, I recall and agree with the words of my predecessor, Professor Roger Smith, in his address at Glasgow in 1883,[1] that the system of flats is opposed to the general feeling; and I agree with him, also, when he says that they are not so unpopular now, and have many advantages.

Of course, the height of houses, whether in flats or separate, varies very much, buildings of five, six, or seven stories being common enough, — my own house has six; but I propose, in the comparative plans which I show, to limit our consideration to four stories, which is the limit suggested by Professor Robinson, in his address at Newcastle, 1882.[2] My plan shows, first, the actual space at present occupied by two blocks, each of fifty-eight two-storied houses, and their open areas of streets and yards; and, secondly, the space which would be occupied and the area gained, if the same number of inhabitants lodged in half the number of houses, but four stories in height. The contrast as to open space is rather striking, and with increased height the size of that space will of course increase.

One thing more. In his well-known address in 1879, Dr. Richardson spoke of his ideal cities as competing with each other in the beautiful as well as the useful, and I have spoken all the way through of doing what we have to do in the streets, the buildings, the fountains, in such a manner as to give a cheerful aspect to the scene, and afford some scope, however slight, to the feeling of beauty which is inherent in mankind, whether for color or form, for a flower or a building, and not to offend the eye by the mean and the ugly.

Years back, in the prime of his life, Mr. Ruskin pointed out[3] most forcibly "that it is chiefly by private and not by public effort that a city is adorned, and that it did not matter how many beautiful public buildings it may possess if they are not supported by and in harmony with the private houses (and, I may add, of the factories) of the town," and if it be held that all we have to do is to provide houses which shall be fairly comfortable, whether for rich or poor, and that rows of such houses will answer all the purpose if built with windows large enough and numerous enough, and that nothing else in them need be studied, then I say that our town lacks one great feature which might conduce to the pleasure of its inhabitants, and in neglecting that we have neglected one means, however slight, towards that healthful mental state which helps the bodily so well.

The Illustrations

[*Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.*]

A CORNER OUTSIDE THE RAMPARTS, QUEBEC, CANADA.

[Gelatine print, issued only with the Imperial Edition.]

HOUSE OF FRANCOIS I, PARIS, FRANCE.

THIS charming bit of early Renaissance architecture was built by François I, in 1523, at Moret, on the edge of the forest of Fountainebleau, for the King's sister, Marguerite, or for one of his mistresses; tradition says it was inhabited by the famous Agnes Sorel. It was sold by the French Government in 1826, subsequently passing into the hands of its present proprietor, who caused it to be removed to Paris, and rebuilt, stone for stone, in its present position at the corner of the Rue Bayard and the Cours-la-Reine, a lovely boulevard extending along the right bank of the Seine near the Champs Elysées. The building is in such a perfect state of preservation that it seems no older than the modern houses immediately adjoining it. It is built on a terrace raised some six feet above the sidewalk and crowned by the balustrade shown in the foreground of the photograph. It is a perfect gem, almost, if not quite, the only pure piece of François I work to be found in Paris, and indeed one of the best examples of the style in existence. The material is the pale yellow sandstone, such as has been used for nearly all building operations in France. The medallions in the frieze over the large windows are portraits of Marguerite de Navarre, in the centre, Henry II, Diane de Poitiers and François I on the right, and Louis XII, Anne de Bretagne and François II on the left. All of the sculptures are attributed to Jean Goujon.

SYSTEM FOR THE LAYING-OUT OF TOWN LOTS DEVISED BY MR. EDWARD T. POTTER, ARCHITECT, NEW YORK, N. Y.

COMPETITIVE DESIGN FOR GRACE CHURCH, KANSAS CITY, MO. MESSRS. JAMES & JAMES, ARCHITECTS, KANSAS CITY, MO.

HIGHLAND EPISCOPAL CHURCH, BIRMINGHAM, ALA. MESSRS. CHISHOLM & GREEN, ARCHITECTS, BIRMINGHAM, ALA.

ANNEX TO CLUB-HOUSE, TUXEDO PARK, N. Y. MR. JAMES BROWN LORD, ARCHITECT, NEW YORK, N. Y.

PARIS GOSSIP.

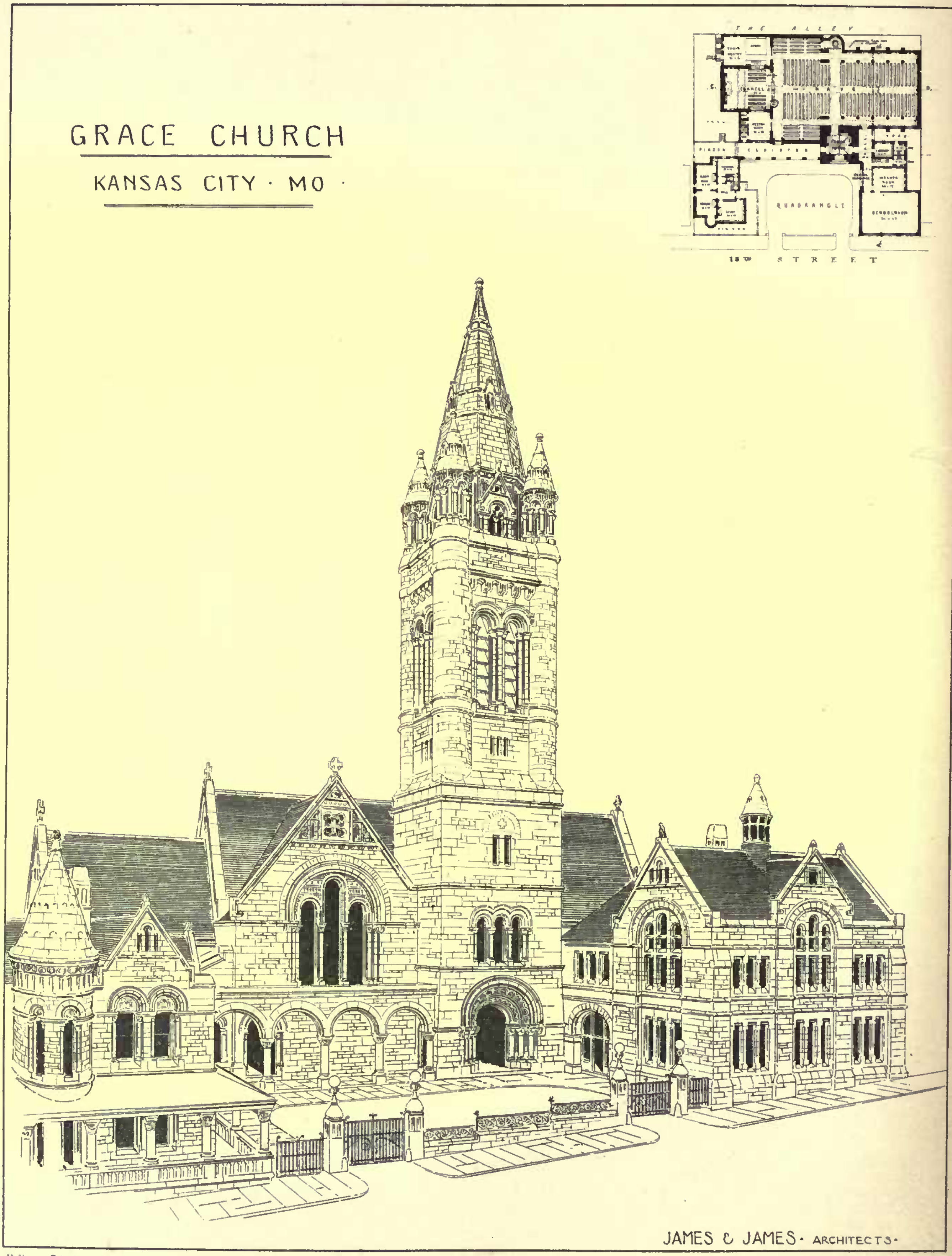


WHEN our friends and former companions come to visit the Exhibition of 1889, those who arrive by the Ligne de l'Ouest will no longer recognize the St. Lazare Station. The old building, small, dirty and inconvenient, will have entirely disappeared, and the moving into the new building will probably not be entirely finished, but the bulk of the work will be done. This, at least, is what the architect in charge of the new building, M. Just Lisch, Inspector-General of Historical Monuments, has agreed to do. I have visited him, and he has with much good nature given me the information which I now transmit to you.

All the part of the Rue St. Lazare, situated between the Rue de Rome and Rue d'Amsterdam, is to entirely disappear, as well as the old entrance to the station, — that narrow and always crowded court-yard, shaped like a horseshoe. In its place a vast court-yard will give access to the grand entrance of the Salle des Pas Perdus, from which broad staircases will lead. This entrance will be used especially by the main lines and the traffic for England. A smaller court-yard will be found at the other end of the station on the side of the Rue de Rome, through which will pass all the traffic for the suburbs, so important on all these lines, the Ceinture, Versailles, St. Germain, Argenteuil, etc. These two great entrances will be separated by a structure which will look, unfortunately, on the Rue St. Lazare, masking the façade of the new station, from which it will be separated by a street eighteen metres wi le. M. Lisch, and everybody else, deplores this arrangement, which absolutely hinders the possibility of giving to the approaches to the station the grand and monumental aspect which every artist ought to seek, and which squares and gardens would have enabled him to give them. But here arises a question of interest. The company owns the land reaching to the Rue St. Lazare, and the houses which are now being demolished. These vested rights are worth seven millions of francs. The income from them should be considerable, and the company cannot inflict on its stockholders the enormous sacrifice which would be imposed on them by not making use of the land. The company was disposed to do all it could, but only with the aid of the State and the city of Paris; but neither the State nor the city could or would aid the company. It has, therefore, been decided to erect upon a fairly large part of the territory between the station and the street buildings which will bring in an income. It is proposed, but nothing is yet decided upon or studied, to construct a large hotel, which the company would build at its own expense, and of which M. Lisch would be the architect. It would have about 3,500 metres of area, and would cost the sum of four or five millions of francs.

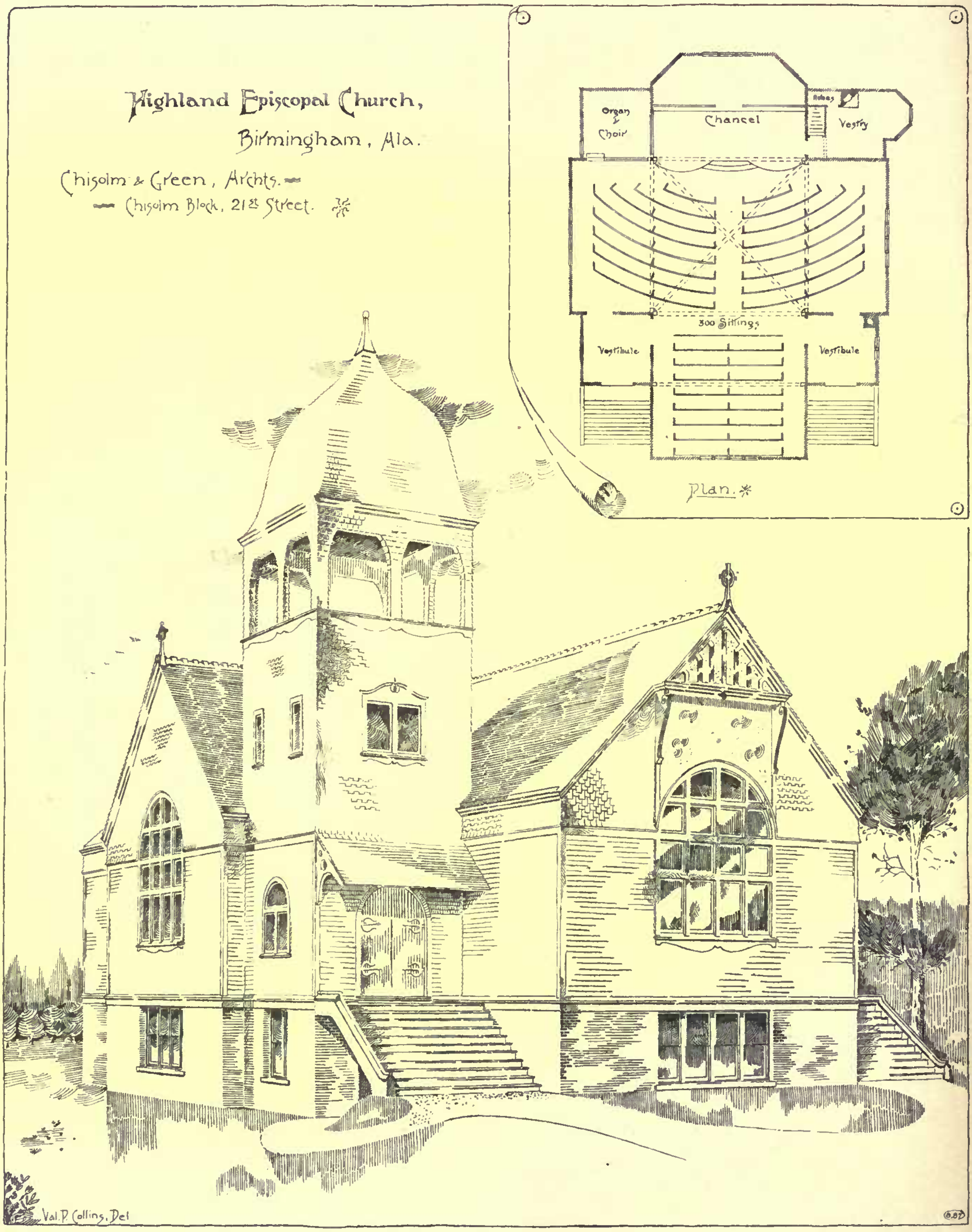
The new station extends, then, from the Rue de Rome to the Rue d'Amsterdam, with a façade of 210 metres. At the ends are the two entrance pavilions, each sixty metres wide. The Salle des Pas Perdus, to which they give access, is that of the old building, but extended on the Rue d'Amsterdam side. Under this hall are the baggage-rooms and the exits for the passengers to the suburbs. The arcades of the present Salle des Pas Perdus are preserved, but will not form part of the façade. This will be distinguished by a closed gallery with segmental arches, where the sale of tickets will take place, and to which the public will not have access. From the width

[1] Transactions of the Sanitary Institute, 1883.
[2] Transactions of the Sanitary Institute, 1882–1883, p. 185.
[3] Lectures at Edinburgh, 1854.

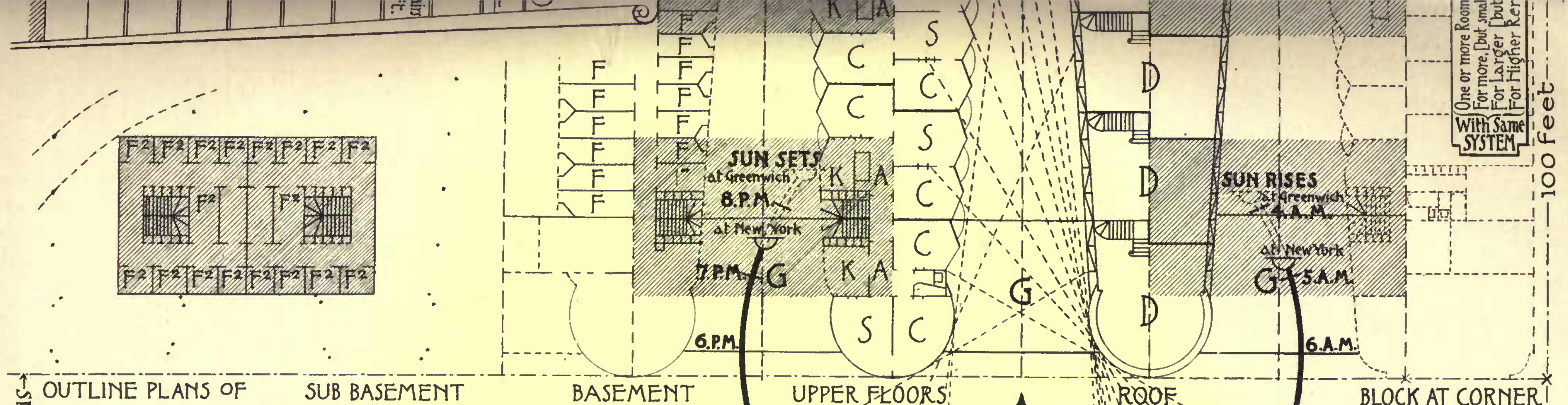


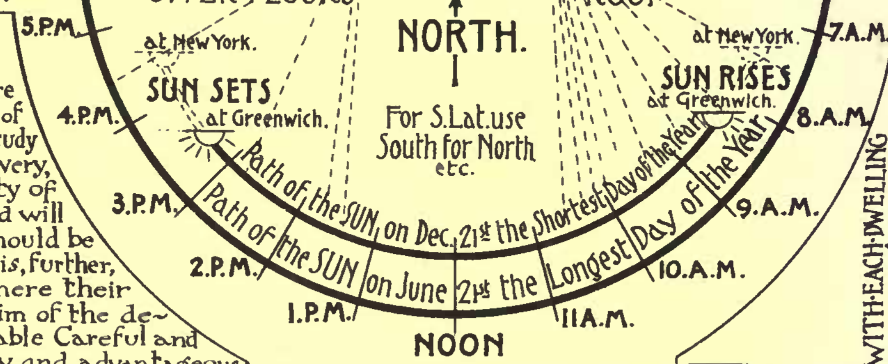
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"IN HOC SIGNO VINCES"



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NOTE: THE SYSTEM, One of the Applications of which is here shown, asks the Attention and, as far as successful, the Recognition of those interested in matters of general Utility. It is the result of a study begun in 1855, of New York Tenement House Evils, resulting in the discovery, some years later, of the local cause of these evils in the Inflexibility of the New York Lot System, and that elsewhere Like causes are, and will everywhere always be, Ultimately Productive of like Evils, and so should be avoided, (See Circular "to whom it may Concern" Sigd W.C.T. Dec 20th 1876); and it is, further, a result of an endeavor to find a way of Avoiding these Evils where their Predisposing Cause is, as in New York, already Established. The aim of the designer has been: To find the Distribution of Spaces which will enable Careful and refined Families to Dwell most Healthfully, agreeably, independently and advantageously on Least Land Space; and yet where any persons living carelessly will do Least Harm to themselves or others. In working out the design it has been assumed that such Comforts as would be thought Necessities by some tenants would probably be acceptable to all tenants. . . . . . Among other SUBJECTS Considered are the following:

* Sea and Land Southerly Breezes; Protection from cold winds N, NE, N.W, Avoidance of Cold Air Currents in Courts; Avoidance of Closebottom Unventilated Courts and Wells of Light; Harms from Sunshine and Sudden Changes of Temperature; Entrances, Etc; Janitors; Protection from Noise; Lightning; Earthquakes; Gales; Use of Wind as Power; Fire-Escape; Slowness to burn, Partial, or complete Incombustibility; Cellulate planning; Heating; Lighting; Smoke Consumption; Drainage; Ventilation; Laundry facilities; Dessicators; Dust; Private lifts or Dumb Waiters; General Lift for Mounting only; Cellars, domestic and for Rent; Shops, Stores Etc. Childrens Play-Grounds; Courts; Paving; City Gardening; Conservatories; Covered sidewalks, their Roofs used as terraces; Glass in roofs; pavements & partitions; Command of, yet independence at pleasure of, Labor-Saving Appliances; Power, compressed air or other, for domestic or other Use; Least Harm to Neighboring Property by overshadowing Etc; Durability, Neatness & Profit of certain materials, (e.g. White Marbles for balconies & stairs, gilt stair railings and Scagliola walls, Stained glass windows, polished hard wood doors & brass mountings in Halls, terazzo di Venezia landings & floors) compared with Other materials; Construction; Finish; Eventual Economy of the best Professional Aid; Etc. Etc.

* The loss to the Majority of its Inhabitants, from Ill-considered planning, is greater in New York than in most Cities, owing to the partial or complete Intercepting from their Dwellings of the Cool Sea Breeze which during the Hot months (i.e. about half the year) prevails there on most Afternoons and Nights.

Constant Factors { The Height of a Man / The Path of the Sun.

INDEX.

WITH EACH DWELLING

- A. Entry.
- Interchangeable. { S. Sitting Room / C.C. Bed Rooms.
- K. Kitchen.
- Bath & W.C.
- Air Duct.
- Fire Places.
- Private Lift.
- L. " Drying Attic.
- " Bleaching Space
- F F² Cellars, Food & Fuel
- Balconies [enclosable with blinds]

STAIRS

- D. D. D. Children's Play Decks.
- General Lift [for Mounting only]
- Covered Bridge.
- Earthquake Pendulums.
- G. G. G. Shops or Stores, one story high [with gardens of Shrubbery & flowers on their roofs]
- O O² O O² Open Air Spaces [O O Courts to stairways. O² O² Gardens]
- Ventilators to Sub Basement: The Sub Basement is thoroughly Lighted & Ventilated. The shaded parts of the Diagram show the positions, in Sub-Basement beneath, of the Fuel Cellars of dwellings. The Rest of the Sub-Basement can be Let for Storage, Etc. . . . The nearly diagonal double dotted lines show one of several paths for possible "Passages" with Shops, Etc. on 1st Story or Sub-Basement levels, successions of which, in line, would save foot passengers the extra distance of nearly a third, & so loss, imposed by planning Cities only rectangularly.

SIDE STREET 60 feet Wide

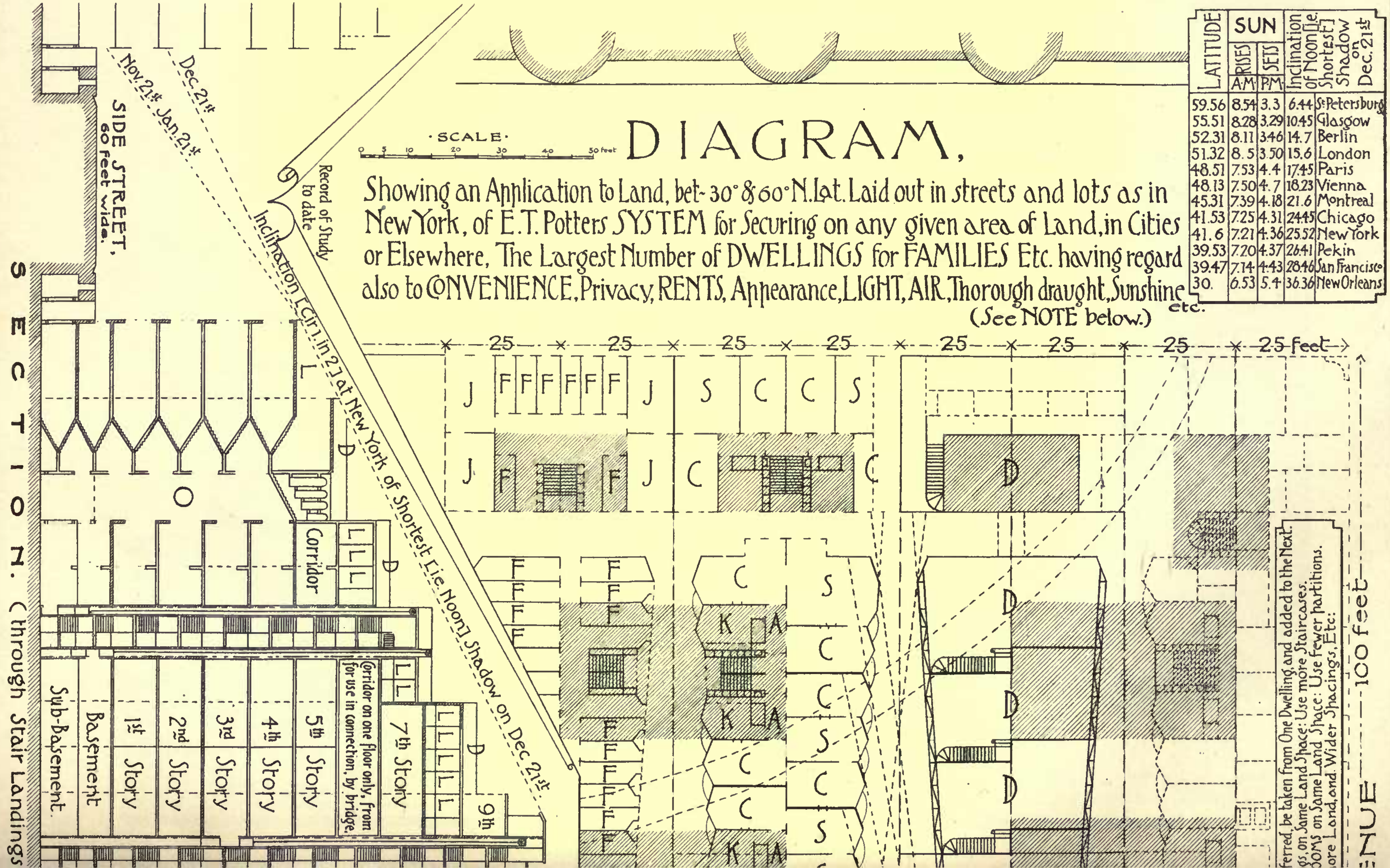
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DIAGRAM,

Showing an Application to Land, bet- 30° & 60° N. Lat. Laid out in streets and lots as in New York, of E. T. Potters SYSTEM for Securing on any given area of Land, in Cities or Elsewhere, The Largest Number of DWELLINGS for FAMILIES Etc. having regard also to CONVENIENCE, Privacy, RENTS, Appearance, LIGHT, AIR, Thorough draught, Sunshine etc.

(See NOTE below.)

LATITUDE	SUN RISES A.M.	SUN SETS P.M.	Inclination of Noon [i.e. Shortest] Shadow on Dec. 21st	
59.56	8.54	3.3	6.44	St. Petersburg
55.51	8.28	3.29	10.45	Glasgow
52.31	8.11	3.46	14.7	Berlin
51.32	8.5	3.50	15.6	London
48.51	7.53	4.4	17.45	Paris
48.13	7.50	4.7	18.23	Vienna
45.31	7.39	4.18	21.6	Montreal
41.53	7.25	4.31	24.45	Chicago
41.6	7.21	4.36	25.52	New York
39.53	7.20	4.37	26.41	Pekin
39.47	7.14	4.43	28.46	San Francisco
30.	6.53	5.4	36.36	New Orleans





·ANNEX·TO·CLUB·HOUSE·
·TUXEDO·PARK·N.Y.

·JAS·BROWN·LORD·ARCHITECT·

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of this gallery will be taken the necessary space for two staircases descending from the Salle des Pas Perdus to the baggage-rooms.

And now I am going to forestall the criticisms which can be levelled at these staircases which M. Lisch desired to have broad and of a single flight, but which the company was obstinate in wishing to divide and constrict. M. Lisch finally succeeded in gaining acceptance for the fine staircases in the two entrance pavilions, and the one on the side of the Rue de Rome has been open to the public for the last two months, and is admired by everybody. Why does the company, which is equally satisfied, although at first opposed to the arrangement, continue to make the same opposition to the other staircases? It is a mystery of which the victim will be the architect, if the company does not give him full liberty to do his best. Let us hope that M. Lisch will win the day. The pavilion on the side of Rue d'Amsterdam will be connected to the old façade of the station on that street, which is preserved only for economical reasons, for its aspect is not satisfactory. At the present moment they are actively carrying on the demolition of the houses on the Rue St. Lazare. The administration buildings, which face the Rue de Rome and form the great entrance pavilion upon this side, are finished, and occupied by the director-general, the administrative council — whose chamber is very fine — and the auditors' bureau. In the attics are the archives, and in the basement the vaults and safes, as well as the printing press for printing all the tickets of the line. These two entrance pavilions will form the most interesting part of the new façade. They are formed by a central portion accented by seven bays, with full-centred arches on the ground floor, and large mullion windows running through two stories above. These bays, with their stone pilasters and segmental arches, are separated by pilasters which support an attic story. The staircase leading to the Salle des Pas Perdus occupies on the ground floor the width of three bays, and is decorated by two fine granite columns. The vestibule which precedes it has the width of five bays. At the ends of the pavilion are two projecting parts, whose roofs rise higher than that of the central building. In each of them on the first story is a grand full-centered arch divided into three bays by two mullions. In the centre of the pavilion, in the attic story, is detached an architectural feature in which is placed the clock. This façade bears little sculpture, — only some bits in the attic story about the clock and the pilaster capitals. What there is is treated with too much delicacy — the foliage is too much detailed. A little more breadth in the execution would have given a more robust appearance.

Near the Pont de l'Europe, and separated from the station proper, rises the brick and stone train-house. This building has been in use since last winter. The new buildings on the side of the Rue d'Amsterdam are still to be built, and the demolition of the buildings upon the other side of this street, in order to give a greater open space for the service of the main lines, is still to be done. Work began in May, 1885. The total expense reaches twenty millions of francs, including the special building for the express department. This new building occupies on the right side of the street next to the Pont de l'Europe a site of 4,500 square metres. At the rear, level with the Rue St. Petersburg, opens the entrance to the grand hall, through which the baggage-wagons pass. This room is brought into connection with the railway, which is twenty feet beneath, by means of two elevators, which enable the wagons to descend and ascend. The floor of this hall is of compressed asphalt on enormous iron beams four metres deep and of thirty metres span, which are borne by twenty-four large piers of cut stone. These piers are about four metres high, and each cost 5,000 francs. The head-room beneath the piers is four metres eighty centimetres, and this height exists everywhere under the great hall. There are eight passageways for wagons of different classes. Each of the wagon elevators is moved by three hydraulic presses, which, with pistons seventeen-and-a-half centimetres in diameter, can lift a weight of ten tons each, which allows the three presses when brought into use together to lift thirty tons. For a weight of twenty tons only two are used, and one only for ten tons' weight. The hoist of these presses is 9.60 m. The upper portion of the elevator-shafts, which are situated in the middle of the main hall, is arranged so as to open in two parts as the wagon rises, and fall down upon each side of the platform bearing the wagon. These two covers close again on the descent of the platform, so that there is never an open space in the floor of the hall. The compression engines for the working of the elevators are situated at Batignolles, at a distance of twelve hundred metres. The duct which connects them with the baggage-building passes under the streets and under the tunnel of the Batignolles, through which all the trains of the Ligne de l'Ouest pass: it cost 300,000 francs. The total expense for the construction of the baggage-building will exceed three million and a half francs. It has been in use for some time past.

The first stroke of the pick was made in March, 1885, and consequently it has taken a little more than two years in building. Such is the present state of the works which throw into confusion an entire corner of Paris, and that will give to the new station when it is finished the aspect which the point of departure of so important a line should bear.

For a month past, at the Palace de l'Industrie in the Champs Elysées, has been holding the Ninth Exhibition of the Decorative Arts. The arrangement of the grand nave is very ingenious and decorative: two great Renaissance staircases ascend from the two ends of the garden to the first story; four porticos in the length of the garden are occupied by the exhibitors; in the centre is a platform for concerts. Unfortunately, the Exhibition itself is uninteresting. I saw nothing very new there: it is always the same bazaar, where one finds gathered together the same furniture, the same bronzes, the same pottery, with which we are already familiar. At present it has no other claim to success than that the concerts, which M. Dambé, the leader of the orchestra of the Opera Comique is giving, are very interesting. So far as the arts are concerned, the art of music is the one best represented at the Palais de l'Industrie.

M. BRINCOURT.

BUILDING MATERIALS.[1] — VII.



IN my last lecture I directed your attention to cements, some of which derive their binding properties from the formation of hydrated compounds of silica, alumina, and lime, and others from simple hydration, or combination with water only. There is, however, another cementing material in very common use, which is of an altogether different character, upon which I have a few remarks to make, commonly known as asphalt, its value depending upon the binding properties of bitumen. Under the general term of bituminous substances are included a variety of inflammable materials found in nature, such as pitch, tar, asphaltum, naphtha, petroleum, differing from each other in consistency, and in various other respects, but all possessing a peculiar and characteristic odor; of these, naphtha is the most fluid, and asphalt the most compact and solid. The largest deposits of this character are those of the Dead Sea and the lake of Trinidad; this tar lake is more than a mile and a half in circumference, and of unknown depth; the bitumen near the shore is solid, but decreases in consistency as it approaches the centre, where the temperature is higher. Extensive bituminous deposits are also found in Auvergne and other places in France, at Seyssel near the Rhone, and elsewhere. The petroleum wells in America and Russia have probably had the same origin as bitumen. These bitumenous deposits are supposed to have resulted from the action of heat and moisture on vegetable substances under pressure, the products of such action which, under ordinary circumstances, would have been evolved as gas, having been compressed into a liquid or solid form. When bitumen is mixed with chalk it forms a compact semi-elastic solid, which is not affected by alterations of temperature, nor reduced to powder by attrition, and such a material is, on account of its plasticity and tenacity, as well as from its being impervious to water, particularly suitable for floors, pavements, and other purposes where it is liable to be exposed to a greater amount of friction. No artificial mixture of bitumenous and calcareous matter is so well adapted for the manufacture of the description of asphalt used for road-making purposes as the natural deposits found at Val de Travers and at Seyssel; its superiority being possibly due to the very perfect manner in which the carbonate of lime is incorporated with the bitumen, owing to the enormous pressure under which these deposits have probably been produced. The native asphalt rock consists, for the most part, of carbonate of lime, more or less impregnated with bitumen, the quantity of which varies from about six to twelve per cent — that from Val de Travers, in the Canton of Neuchatel, containing rather more bitumen than the Seyssel. The prepared asphalt, as sold by the makers, is termed "mastic," for the manufacture of which the asphalt rock is crushed under a steam hammer, and ground to powder by edge-runners. The powdered rock is then carried forward by means of an endless screw to cast-iron vessels placed over a fire, in which it is mixed with suitable proportions of fine sand and bitumen, and kept constantly stirred for from two to three hours, when it is run out into blocks of one hundred and twenty pounds in weight. When the mastic is used, it is reheated with more bitumen, in order to render it sufficiently fluid, more or less coarse sand being mixed with it, according to the purpose to which it is going to be applied. Coal-tar pitch is sometimes used instead of mineral bitumen, but this deteriorates the quality of the asphalt, coal-tar pitch being a hard brittle substance which does not possess the toughness of mineral bitumen; it softens readily when exposed to heat, and pavements made with such asphalt are liable to become soft and adhesive under the influence of a hot sun. Good asphalt should withstand a temperature of from 140° to 160° Fahrenheit without being affected to any appreciable extent, and should not become so fluid as to run down below a temperature of 260° Fahr.

PRESERVATION OF WOOD.

The best means of preserving timber from decay, and enabling it to resist for the longest possible period those changes that are included under the term eremacausis — which may be regarded as a species of slow combustion of the constituents of the wood with the

[1] A lecture by W. Y. Dent, F.C.S., F.I.C., read before the Society of Arts, and published in the *Journal* of the Society. Continued from page 173, No. 615.

oxygen of the atmosphere — is a subject that has for many years occupied the attention of chemists and engineers.

Wood consists of a mass of cells or fibres, the newer portions of which are filled with the particular kind of sap appertaining to each special description, which, when the life of the plant ceases, can no longer resist the influence of the surrounding air and moisture, but begins to be subjected to a process of oxidation as the air gains access to the juices of the sap through the tissues of the wood. These juices consequently begin to ferment and decompose, the albuminous constituents, or those containing nitrogen, being the first to undergo this change, which proceeds from these to the mucilaginous, such as sugar, starch, and gum. This fermentation is assisted by the moisture contained in the wood, and is attended with the appearance of fungoid growth, when it is generally known by the term "dry-rot." This dry-rot fungus possesses the property of secreting moisture, even from a moderately-dry atmosphere, and hence, when once the growth of this fungus commences, it proceeds with rapidity, since it is able to procure for itself the moisture that is essentially necessary for its increase. Unseasoned wood contains within itself the elements of decay, and affords the conditions necessary for the development of the dry-rot fungus. When such wood is placed in situations where there is not a free circulation of air, this fungoid growth soon makes its appearance, and the germs spread rapidly in every direction, the wood becoming, in a comparatively short time, reduced to the condition of fine dust.

When wood is thoroughly seasoned, external moisture is necessary for the commencement of this process of decay; but perfectly dry wood shows but little tendency to alteration, as we find to be the case with the gopher wood found in Egyptian catacombs. Timber of slow growth is less liable to decay than when it arrives quickly at maturity, this being the case even in timber of the same description. It has been stated that telegraph poles made from trees grown in the comparatively-rich soil of Devonshire begin to decay in a shorter time than poles made from the larches grown in the Highlands.

When timber is immersed in water containing air in solution, and the air is constantly being renewed, the woody fibre will, in course of time, be converted into a dark-brown substance, to which the name of *humus* has been given, this being one of the constituents of vegetable mould.

It is well known that the decay of wood under such circumstances is rapid, as is the case in tidal rivers, or in other situations in which the wood is alternately exposed to the action of air and water, as compared with wood immersed in deep water, or in still water that is not changed. The air contained in such water becomes exhausted of its oxygen, and the process of decay is arrested, or may never take place to any extent. Accordingly, it is found that piles driven in deep water, or in clay or mud, will remain sound for an almost indefinite length of time, as was exemplified in the elm piles of old London Bridge which, when taken up, were found to be in a sound condition after the lapse of eight hundred years. Only a few years ago two canoes, each formed from a single log of oak, were recovered in good condition from the bottom of a loch in Aberdeenshire, where they are supposed to have been lying for 1,000 years. More recently, a boat, similar in character to those canoes, was discovered at Brigg, in Lincolnshire; and in 1881, in making excavations for steam docks at Liverpool, a portion of a ship was found which must have been embedded for at least two hundred years, the elm beams of which were in a perfectly sound condition. Besides being liable to gradual decomposition by the ordinary and natural processes of decay, timber is liable to be injured by the attacks of boring worms, the most formidable of which are the *teredo navalis* and the *limnoria terebrans*, and also in hot climates by that very destructive insect, the white ant. The capabilities possessed by different kinds of wood of resisting these attacks vary considerably. Those descriptions which contain a large amount of resinous matter, such as the greenheart timber of Demerara, and pitch pine, *pinus rigida*, are less liable to such attacks than much harder woods which are of a less inflammable character. The greenheart timber contains so much empyreumatic oil that it is known by the name of torchwood, on account of its burning freely, like pitch pine, and there is no doubt that it is from the presence of this oil that it derives the power which it possesses of resisting these attacks to a greater extent than most other descriptions of wood. There are other woods that are reputed to have similar capabilities of resistance, of which there were a number of very fine specimens in the Colonial Exhibition. Amongst these may be mentioned the billian, a hard, very dense wood, and the russak wood from North Borneo; the cypress pine from Queensland; sneezewood from the Cape of Good Hope; horseflesh-mahogany from the West Indies; the karri (*eucalyptus diversicolor*), growing sometimes to the height of three hundred feet, and the jarrah (*eucalyptus marginata*), of which there was a beautifully-polished specimen in the Exhibition from Western Australia. This wood was used for a portion of a jetty at Perth, on the Swan River, Western Australia, and remained perfectly sound after the lapse of thirty years.

Greenheart timber was, for a long time, considered to be safe from the attacks of boring worms, but the experiments carried out some time ago by the Dutch Government with this as well as with other descriptions of wood, show that none of these woods can be thoroughly depended upon when placed in situations most favorable to the increase of these destructive agents. The extension of the railway system gave rise to the employment of an immense number of wooden sleepers, and the rapidity with which they were found to decay rendered some means of preserving them an absolute necessity, and accordingly we find that various methods have, from time to time, been proposed for the preservation of timber, some of which have been carried out in practice with more or less successful results. The efficacy of any such process depends upon the power of the material employed to so change the sap as to render it not susceptible of putrefaction, while it imparts to the wood such properties as will be unfavorable to fungoid growth, and will render it to a considerable extent repellent of water. The first process to receive any extensive practical application was that known as kyanising, which was the subject of patents taken out in 1832 and 1836 by Mr. Kyan, and consisted in steeping the wood in open tanks in a solution of bichloride of mercury, commonly known as corrosive sublimate. The impregnation of wood with a salt which is known to be so fatal to animal life could scarcely fail to prove effective; and this process was for many years very generally adopted. The cost was considerable, as to render the process efficient it was necessary to employ a solution containing one pound of the mercury salt to four gallons of water, and a load of timber was found to absorb as much as from six pounds to seven pounds of the salt. This process has for many years been to a great extent superseded by others of a less expensive as well as more effective character, since although the use of corrosive sublimate was perfectly successful in dry situations, it did not always prove so satisfactory when the wood was subjected to the action of sea-water.

Chloride of zinc is a salt which has long been known to possess considerable antiseptic qualities, and in 1838 a patent was taken out by Sir William Burnett for the use of this salt as a preservative of wood. In carrying out his process he adopted the apparatus first proposed by M. Bréant in 1831. The wood was placed in closed iron cylinders into which, after exhausting the air, a solution of zinc chloride was admitted, and then forced into the pores of the wood under a pressure of one hundred and fifty pounds to the square inch. This process was employed on a considerable scale for many years, but it has now given place to more efficient methods, although it is still used to some extent in Germany.

Some years ago a number of experiments were carried out by Dr. Boucherie, who very ingeniously availed himself of the force of the ascending sap in growing trees, by causing it to draw up various solutions. A large incision was made in the lower part of the tree, round which a trough of clay was placed, filled with the preservative solution to be tried, and this was carried up with the ascending sap. When experiments were made with felled timber, the trunk was immersed in a closed vessel which was filled from a reservoir placed at a considerable height above, so as to obtain a pressure of thirty or forty feet, and in this manner Dr. Boucherie succeeded in replacing the sap of the timber by solutions possessing properties which were likely to preserve the wood. Of the various salts experimented with, copper sulphate gave the best results. This method of applying the solution was adopted for a short time in France; it possesses the advantage of requiring no machinery, and of being capable of application upon the spot, and hence it has sometimes been found useful for newly-cut wood required for telegraph-poles. The peculiar action which copper salts exert upon cellulose has long been known, and in 1837 a patent was taken out by Margary for the use of sulphate of copper as a preserving agent for timber. This salt was extensively employed for many years, the impregnation of the wood being accomplished by the use of exhaust and force pumps, and it subsequently became the process most generally adopted in France. The effect of copper salts in the preservation of vegetable fibres from decay is strikingly illustrated in the case of what is known as the Willesden canvas. Fabrics of canvas or paper can be made perfectly waterproof by the action of a solution of the copper salt employed in the Willesden process; they are free from liability to mould, are not injured by wet, and are rendered capable of resisting the attacks of vermin of every description. This canvas has been used in the most trying climates, such as Egypt and India, and was employed by Stanley in fitting out his expedition to Africa. The copper solution employed is prepared by simply dissolving hydrated oxide of copper in strong liquid ammonia. The goods to be subjected to this process are passed through a bath of this solution, at such a rate as to cause the exterior portion of the fibres of the canvas or paper to become pectized or gelatinized, without allowing sufficient time for the action of the copper-salt to proceed so far as to injure the strength of the material; the canvas is then passed over drums, such as are used in ordinary paper-mills, and dried, whereby the film of pectized cellulose is converted into an insoluble varnish. The paper or canvas can be made of any required thickness by passing two or more at the same time through the bath, pressing them together, and then drying, thus producing a material of sufficient strength for the purposes of light roofing.

By far the most important of all the methods now employed for the preservation of timber, and adopted almost to the exclusion of all others in England, Belgium and Holland, is that known by the name of creosoting, which consists in impregnating wood with an oily liquid termed "dead oil," or heavy oil of tar, obtained in the distillation of gas-tar.

The efficacy of pitch, tar and bituminous substances generally, as preservatives from decay, has been recognized from a very remote period, as we learn from the historical records of the Egyptians, Greeks and Romans. The Egyptians undoubtedly displayed very

great skill in the manner in which they conducted their processes of embalming. Bitumen, in one form or other, appears to have been largely employed, and their success could hardly be more strikingly exhibited than in the case of the heart of an Egyptian mummy which, after having been preserved for some 3,000 years, began to decompose upon the removal of the antiseptics employed. In the writings of Herodotus and Pliny we find a description given of pitch, tar and resin, and from the latter celebrated writer we learn that the Romans were acquainted with the fact that timber was less likely to decay when kept continuously under water than when exposed alternately to the action of air and water, and also that they knew something of the destructive powers of the teredo.

The application of tar distillates to the special purpose of the preservation of wood was proposed as far back as 1754, when a patent was taken out for a varnish prepared from the American pit h pine, and for a product obtained from the distillation of tar to be applied as a preventative of decay in wood. In 1838, and again in 1848, patents were taken out by Mr. Bethell for the use of tar liquor.

There is perhaps no practical application of chemical science to manufacturing operations that has yielded such splendid results as have attended the investigation into the nature and composition of coal tar. Fifty years ago, no one would have ventured to surmise that in what was then regarded as an almost valueless, dirty and evil-smelling waste product, obtained in the purification of gas, would be found the source from which would be produced a most splendid series of organic products that would not only rival the colors obtained from indigo and madder, but in many cases supersede them altogether, and create an enti.e revolution in the whole system of dyeing.

In distilling coal tar on a manufacturing scale, it is placed in a large iron still capable of holding about 2,.00 gallons, heated by a furnace underneath, sometimes assisted by the injection of steam, and the application of an exhaust air-pump. As the still becomes heated, a light naphtha distils over between about 170 degrees and 320 degrees Fahr., which is of great commercial importance, inasmuch as it contains benzole or benzine, from which is obtained aniline, the basis of a series of colors, such as mauve and magenta. Between the temperatures of 320 degrees and 370 degrees Fahr. is distilled the liquid known as coal-tar naphtha, which is used so extensively for burning in lamps, and as a solvent for India rubber. The liquor used for creosoting timber, termed "dead oil," or heavy oil of tar, from its being heavier than water, distils over between 370 degrees and 750 degrees Fahr.; the resolution in the still is run out whilst hot, becomes perfectly solid on cooling, and constitutes the substance known as coal-tar pitch. This dead oil, or creosoting liquor, is of a very complicated character, consisting of a variety of hydrocarbons of different degrees of volatility, and possessing by no means the same antiseptic properties, the relative value of which, in this respect, it is difficult to estimate with any degree of accuracy. In the lighter portions are found carbolic and cresylic acids, substances which have long been known as possessing very great disinfecting properties, so much so, that for a long time they were regarded as the active agents upon which the value of the creosoting liquor (as a preservative agent for wood) depended. Within the last few years, however, the opinions of chemists have undergone considerable modification in this respect, and there appear to be sufficient grounds for believing that the relative value of creosoting liquors is not represented by the percentage of these acids which they may contain, since, owing to their volatility, they are not retained by the wood for so long a time as some of the other constituents. In the heavier portions of the liquor, or "green oil" as it is termed, distilling over between 550 degrees and 750 degrees Fahr., are found a number of alkaloids, or bases, amongst which is a powerful germicide of a very pungent and acrid character, termed "acridine," which having a very much higher boiling point than that of carbolic or cresylic acids, is more permanently retained by the wood. The minute glistening scales generally observable on recently creosoted wood, consist of naphthalene, a substance that possesses considerable antiseptic properties; when this substance exists in the liquor in moderate quantities, it thickens and improves its consistency; but when there is a very large proportion, as is frequently the case with creosoting liquor obtained by the distillation of coal-tar produced at gas factories in which Newcastle coal is employed, it makes the liquor too solid. To be of proper consistency the liquor should be completely fluid at 100 degrees Fahr., and should exhibit no signs of any deposit on cooling down to a temperature of 90 degrees Fahr.

There are two classes of creosoting oil, known in the trade as London oils and country oils. The London oils, which consist of those obtained from the gas-tar derived from Newcastle coal, contain a larger proportion of naphthalene, and are heavier and thicker than the country oils of the Midland districts, which yi.ld a larger proportion of tar acids (as they are termed), consisting of a distillate which is capable of being dissolved by a solution of caustic soda containing nine per cent of the alkali. Previous to the year 1863, only a comparatively small quantity of. these thin country oils had been used for creosoting purposes, but they subsequently became more in demand, under the impression that the value of the oils depended upon the proportion of tar acids they contained. This question was investigated in 1866 by Mr. Coisne, an engineer in the service of the Belgian Government, whose experiments were continued during a period of five years, and the results obtained led him to the conclusion that the so-called green oils, distilling over at high temperatures, formed the best portions of the creosoting liquor, and that the importance of the tar acids had been much overrated.

In carrying out the creosoting process on a large scale, the dried wood (cut up into the sizes in which it is going to be used) is placed upon iron trucks, which are run on a tramway into large air-tight cylinders six feet in diameter, and from twenty feet to seventy feet in length, heated by steam-pipes placed along the bottom. When the trucks have been run into the cylinder, the end is closed, steam is admitted to the heating pipes, and an exhaust-pump is put in action which is capable of creating a vacuum of twenty-five inches. When this has been attained, the creosoting liquor is admitted from a reservoir, in which it has been kept at a temperature of 120 degrees Fahr., by means of steam pipes. A force-pump is now put in action, by which a pressure of 150 pounds on the square inch is maintained for a period of from six to ten hours, the temperature of 120 degrees Fahr. being also kept up by means of the steam-pipes; the amount of pressure given, and the length of time that the steeping is continued, depends upon the description of wood to be treated, and the quantity of creosote that is required to be absorbed. When cost is no object, the penetration of the liquor as regards some descriptions of wood which absorb the most readily, such as beech and deal, is capable of being extended to a depth of ten inches, but, as the process is usually carried out, the penetration does not extend further than from half-an-inch to four inches. The progress of the absorption of the liquor by the wood is ascertained by observing the quantity left in the reservoir, which is registered by a gauge, the amount usually required being about one gallon to a cubic foot of timber of the sizes employed as railway sleepers. When the wood has absorbed this quantity, the pressure is removed, the liquor remaining in the cylinders is run off, the end is opened, and the trucks with their loads of creosoted wood are withdrawn. I have stated that in carrying out the creosoting process, as above described, it is necessary that the timber should be dry. Now it is well known that timber is injured by exposure to a dry heat, 230 degrees Fahr. being the extreme limit to which it can be exposed without liability to injury, and all attempts that have been made to effect the drying by stoves, currents of hot air, or superheated steam, have had to be abandoned; but by a modification of the creosoting process patented by Mr. Boulton, the moisture can be removed at the commencement. For this purpose a dome is fitted to the top of the cylinder, the liquor is admitted at a temperature only slightly exceeding 212 degrees Fahr., and the action of the exhaust-pump is continued for some time after the admission of the liquor.

It will be seen that the wood is thus subjected to a moist heat above the boiling point of water, by which the water in the pores of the wood is converted i :to vapor and drawn off by the action of the suction-pump, the creosoting liquor taking the place of the w ter withdrawn from the wood. When the creosoting process has been properly carried out, the wood will be found to have increased in weight to the extent of from eight pounds to ten pounds per cubic foot, and to have been rendered so secure against the attacks of the marine boring worm, that a piece of timber has been known to have been riddled by such attacks in places where the liquor has not reached, and to be untouched where it had been properly impregnated with the creosoting liquor. This tar liquor not only possesses those antiseptic properties by which fermentation and the growth of insect life is arrested, as well as the power of coagulating the albumen of the sap in the same manner as in the case with copper sulphate or corrosive sublimate, but it also possesses the additional advantage of impregnating the wood with a liquid of an oily nature which is repellent of water. The efficacy of this process, and its superiority to all others that have been yet tried, is supported by the results of numerous experiments that have been made with great exactitude and care, both in this country and abroad, by engineers and others. There is no country so deeply interested in the protection of timber as Holland, on account of its having such a large extent of coast protected from encroachments of the sea by dykes that are constructed of timber. On several occasions fears have been entertained of large portions of the country becoming submerged owing to the destruction of the timber dykes by the ravages of the teredo, which works with such rapidity that in some instance piles have been known to have been eaten away to a dangerous extent in the course of a few months. The question of the preservation of their timber piles became one of national importance to the Dutch Government, and a commission was appointed, consisting of engineers and members of the Royal Academy of Amsterdam, to institute a thorough investigation of the subject. The experiments carried out by the commission were divided into three groups:

1. Applications to the surface of the wood: which included carbonizing or charring the wood, by subjecting it to a hi.h temperature; treatment with paraffine; covering with sheet copper or zinc; covering with broad flat-headed iron nails, driven in close together and allowed to rust.

2. Impregnation with different liquids, including solutions of sulphate of copper, sulphate of iron, acetate of lead, water-glass, chloride of calcium and creosoting.

3. Different kinds of unprepared wood.

The conclusions that they arrived at were: That the only reliable process for protecting wood from the attack of the teredo was that of creosoting, and that even this fails if the process has not been properly carried out; that no kind of unprepared wood (greenheart

included) is to be altogether relied upon as secure against the attacks of the teredo.

The descriptions of wood used in the construction of the dykes are fir, beech and poplar. Some time ago twelve piles of each of these woods were sent over to this country to be creosoted, these were returned to Amsterdam, and placed in positions where improperly creosoted wood had previously been destroyed, and in no instance were any of the twelve piles attacked by the teredo. Some years ago experiments were made at Plymouth with different kinds of wood, consisting of red and yellow pine, American and English oak, elm, beech, fir and pitch pine, which, after being dried in an open shed, were subjected to the following processes, viz., creosoting (one gallon of the liquor per cubic foot being forced into the wood), kyanizing, and the sulphate of copper process. Blocks of each kind of wood, after being subjected to the several processes, as well as others without any preparation, were sunk in still water to the depth of twenty feet, and, after remaining for two-and-a-half years, were taken up and examined. All the creosoted pieces were found to be sound, and all the unprepared pieces were worm-eaten. Of the kyanized, five were sound and three slightly attacked; and of those prepared by the sulphate of copper, only one was sound. The increased use of creosote is shown in a report of July, 1884, to the Technical Convention of the German Railway Union, in which it is stated that in 1865 there were fifteen railway companies in Germany employing the sulphate of copper process, and only four the method known as creosoting; but that in 1884 there was only one using the sulphate of copper process, whilst eleven had adopted that of creosoting.

We have now had nearly fifty years' experience as regards creosoted timber. Wood so prepared was employed in the construction of dock gates at Monk Wearmouth as far back as the year 1839; creosoted wood was also employed on a considerable scale, in 1846, at Lowestoft. The evidence that can be produced of the value of this process as a means of preserving wood so far exceeds anything that has been advanced on the part of any other, that its claim to be regarded as superior to all other processes at present known, and as that upon which the greatest reliance can be placed, may be considered as fairly established.

The teredo is a gray-colored worm, ordinarily, when full grown, about ten inches or twelve inches in length, but in favorable situations (such as the Gulf of Mexico) it will sometimes attain a length of twenty-three inches. It is a species of mollusc, having at one extremity a boring apparatus of the most perfect description, consisting of a hard, shell-like substance, which fulfills the part of an auger and a rasp. The teredo first makes its appearance in the form of a very minute egg; the eggs are laid at the commencement of the warm season, and are hatched in the water, giving out larvæ so small as to escape notice of the inexperienced observer, being not more than about one-twenty-fifth of an inch in length. After swimming about for a day or two, they begin to search for timber, which they enter by boring a very minute hole not larger than a pin's point; it is therefore of the greatest importance that no portion of the surface of the wood should be left unprotected by the preserving agent employed, and hence arises the necessity for cutting up the wood into the sizes in which it is to be used before submitting it to the creosoting process. The teredo grows rapidly under favorable circumstances, enlarging its hole as it increases in size. Its smaller end (consisting of two tubes) is attached to the end of its burrow, whilst its other extremity, armed with the auger, is pushed forward into the wood, the length of the tunnel corresponding with that of the teredo. As it progresses, it deposits a coating of carbonate of lime upon the sides of its cell, in which it continues to increase for from twelve to eighteen months, and then dies, after blocking up the entrance to its burrow with carbonate of lime. This stopping is soon penetrated by the water, which washes out the lining, leaving a smooth clean hole to bear witness to the destructive habits of this dangerous enemy to wooden structures. The teredo perforates in the direction of the grain of the wood as far as possible, but on meeting with a knot or anything which it regards as obnoxious, it avoids the obstacle by working round it, or it will work back and begin a branch tunnel, taking care to seal up the abandoned portion of its cell with carbonate of lime. It is a curious fact that although there may be hundreds of these worms in the same piece of timber, they never break into a neighbor's tunnel, although they will cut away within a hair's breadth of each other, or of the outside of the timber. A division, however thin, is always left intact. The teredines thrive best in salt water and in warm climates, muddy fresh water being destructive to them.

[To be continued.]

A Runic Inscription at Schleswig. — The *Hamburger Nachrichten* reports the finding in the town of Schleswig of a large stone with a Runic inscription. A new barrack is being built on the ruins of the old castle of Gottorp, erected in the sixteenth century, and in demolishing the old foundations the workmen laid bare this stone in perfect condition. It stands about 120 centimetres (nearly four feet) high, and is about a foot broad. It has an inscription in the usual characters on two faces, and the style of the writing is said to correspond with what has been found on three other similar stones found in Schleswig or the neighborhood. It is in the line of the dyke known as the Dannewerke, and probably covered a grave. The inscription has been partially deciphered, and is said to probably run as follows: "Osfrida made this mound, the daughter of Vinthingar, to Sigtrig, the King, her son, on the holy place."

SOCIETIES

AMERICAN INSTITUTE OF ARCHITECTS.

In accordance with the previous notice of 1st September, the Twenty-first Annual Convention of the Institute will be held on Wednesday, Thursday and Friday, October 19, 20 and 21, 1887, at Chicago, in the rooms of the Literary Club, in the Art Institute, corner of Michigan Boulevard and Van Buren Street.

Order of Proceedings.

FIRST DAY. — MORNING SESSION, 10 A. M.

1. Opening address, by Pres. Thomas U. Walter, LL.D., or, in his absence by First Vice-Pres. Edward H. Kendall.
2. Report of the Board of Trustees.
3. Report of the Treasurer, and appointment of Auditing Committes thereon.
4. Reports of the standing committees on (*a*) Education and (*b*) Publications.
5. Reports of the Chapters in Baltimore, Boston, Chicago, Cincinnati, Indianapolis, New York, Philadelphia, Rhode Island, San Francisco, St. Louis and Washington.
6. Report of the Secretary for Foreign Correspondence.
7. Appointment of Nominating Committee for the election of officers and standing committees for the ensuing year.
8. Reports of Special Committees:
   (*a*). On bill to provide improved methods in the Architectural Service of the Federal Government; in conference with Special Committee of the Western Association of Architects.
   (*b*). On Architects' Protective Associations.
   (*c*). On providing a permanent home for the Institute.
   (*d*). On a building contract for use throughout the United States; in conference with Special Committee of National Association of Builders, U. S. A.
9. Appointment of Special Committee for the consideration of all reports presented to the Convention.
10. Communications, announcements, and miscellaneous business.

RECESS.

The Convention, as the guests of the Chicago Chapter of the Institute, and of the Illinois State Association of Architects, will, after each morning session, take lunch together; and, on such afternoon as may be announced at the first session, their hosts will drive them to points of architectural interest in the city and vicinity.

EVENING SESSION, 8 P. M.

Exhibition of illustrations of work executed, within the last ten years, by such practitioners as may have responded to the official invitation to be issued by the Western Association of Architects, and of which preliminary notice, at the Association's request, was given by the Secretary of the Institute in his circular letter of 1st ultimo, to Institute Fellows and Associates.

SECOND DAY. — MORNING SESSION, 10 A. M.

1. Unfinished business.
2. Amendments to By-Laws.
3. Report of Nominating Committee.
4. Report of Special Committee, for the consideration of reports.
5. Election of officers and standing committees.
6. Reading and discussion of papers.

The following papers, among others, on themes suggested to the authors, have been promised; and several are already in the hands of the Committee of Arrangements:

By Mr. D. Alder, Fellow, on "Theatres."

By Mr. M. E. Bell, Fellow, late Supervising Architect of the U. S. Treasury Department, on "The National Building Question."

By Mr. W. W. Boyington, on "Differences between the Methods of Architectural Practice prevalent now and fifty years ago."

By Mr. D. H. Burnham, Fellow, on "Suggestions towards the best and speediest methods for harmonizing and utilizing all the architectural societies in the United States, so as to secure the most good for architecture, for the public, and for the profession in America; due regard being had as concerns means, alike to individual energy and enthusiasm, and to associative experience; and, as concerns ends, alike to local sentiment and to national reputation."

By Mr. J. C. Cady, Fellow, on "Opera Houses."

By Mr. Chas. H. Harn, on "Manual Training as applied to the Building Arts."

By Mr. John Moser, Fellow, on "Federal Buildings for Judiciary, Customs and Postal Service."

By Mr. J. L. Smithmeyer, Fellow, on "Library Buildings."

By Mr. J. M. Wilson, Fellow, on "Where the line of demarkation between Engineering and Architectural Practice is to be found."

7. Communications, announcements, and miscellaneous business.

RECESS. — LUNCH. — EVENING SESSION, 8 P. M.

1. Unfinished business.
2. Reading and discussion of papers continued.
3. Communications, announcements, and miscellaneous business.

THIRD DAY. — MORNING SESSION ONLY, 11 A. M.

1. Unfinished business.
2. Reading and discussion of papers concluded.
3. Miscellaneous subjects and discussions.
4. General business, communications, announcements, resolutions of thanks, and adjournment.

There are two eligible hotels — on the European plan — in the immediate vicinity of the Convention's place of meeting; one, the Leland Hotel, Michigan Boulevard, corner Jackson Street, where rooms may be had from $1.50 per day upwards; the other, the Richelieu Hotel, Michigan Boulevard, between Jackson and Van Buren Streets, where luxurious quarters may be had at from $2.50 to $20 per day.

Visiting members will find, at the meeting-room of the Convention, a visitors' book in which they are particularly requested to register, promptly on arrival, their addresses, both at home and in Chicago; residents of Chicago will also please register.

Although, owing to the impossibility of getting the promise of attendance at the Institute Conventions in sufficient numbers, as well as to the widely-separated points from which members — often but a single individual from one place — start for the point of meeting, it has hitherto been found impracticable for the successive Committees of Arrangements to secure a general system of reduced rates for railroad travel; it is, nevertheless, suggested — and it has indeed been found feasible in several cases heretofore — that, if the various Chapters, each in its own locality, will organize a visiting delegation to the Convention, they may, through their local business and social connections, induce the railroad officials, in their several places of residence, to reduce rates for a dozen or even for a half dozen friends or acquaintances to a figure which would be refused, to an isolated individual, and a proposition for which, unless on the understanding of tickets being taken by the hundred, as usual where conventions are concerned, would receive no attention whatever if made by a distant Committee of Arrangements.

All reports or communications for the Committee of Arrangements should be mailed in time to reach the Secretary, A. J. Bloor, 18 Broadway, New York, before the 14th inst., so as to give the Committee time for study and proper classification before leaving for the Convention; but when delay beyond that date is unavoidable, they may be forwarded direct to Mr. H. L. Gay, 15 East Washington Street, Chicago. He will also, on account of the Institute, receive illustrations for the Exhibitions hereinbefore mentioned.

They should be in his hands by the 12th inst., and an invoice thereof should be mailed to him.

1st Oct., 1887. [Seal A. I. A.] W. L. B. Jenney, E. T. Littell, Henry Lord Gay, A. J. Bloor, } *Committee of Arrangements.*

COMMUNICATIONS

DISPUTED COMMISSIONS.

September 22, 1887.

To the Editors of the American Architect: —

Dear Sirs, — We have a case of disputed commissions and bill for partial service, which we would like to submit to you for advice.

Last July a client from another city came to see us and instructed us to prepare sketches for a dwelling to cost $9,000, and for a barn to cost $1,000. We did so and went to see him and submitted them. As they were not entirely satisfactory we made changes in them, and also made entirely new designs according to his suggestions. These we again submitted, spending the greater part of a day looking them over and making slight alterations. He took them home to look over more at leisure, and seemed to feel pretty well satisfied that they would suit, and said he would write us the result.

On August 19 we received a letter saying that as there were several things about the plans that were not just as desired, and as the season was so far advanced they thought they had better not attempt to break ground this fall, and that if they waited till spring they could have a long time to get everything ready.

On September 12 we received another letter saying they had written to another firm of architects for plans, which were sent immediately and were so entirely satisfactory that they accepted them, and saying that our plans not being entirely satisfactory, they hoped we would not feel in the least offended, and if we would send a bill they would remit at once.

We sent bill for preliminary studies, one per cent on $10,000, and travelling expenses $4.87, making total bill $104.87.

In reply we received letter saying they begged to enclose check for $35 in payment for our time and travelling-expenses, which they "considered sufficient compensation," and that they thought bill rendered very much too high.

We returned the check for $35, saying we would not accept it in settlement of account, and explaining that our charges were the usual and proper ones, and enclosing a copy of the schedule of charges of the American Institute of Architects.

In the course of the above correspondence we asked our client to return us the sketches at his convenience — which he has done.

We want to ask you for information on two points:

1. To whom do the sketches belong now?
2. Is not our claim perfectly just and proper, and can it not be collected by law?

By advising us in regard to this matter you will confer a very great favor upon Yours respectfully,

"Architects."

[The charge is perfectly proper and reasonable. Under the present state of the law, however, the client should be permitted to retain possession of the sketches. He would not, of course, use them without further proper compensation to the designer, but the courts would sympathize with him in thinking that he ought to have something to show for his money. — Eds. American Architect.]

Riverside, Cal., September 27, 1887.

To the Editors of the American Architect: —

Dear Sirs, — Have bought the first sample copy of the *American Architect*, and if "X. and Y.," on page 139, No. 612, Regular Edition, will read page 13 of *Carpentry and Building*, January, 1887, they may, by inquiring of the editors of said paper, receive information which may be of help in their case.

Yours respectfully, E. E. Blyler.

CONTINUOUS GIRDERS.

To the Editors of the American Architect: —

Dear Sirs, — I have been discussing a very trivial question of construction with some strangers to the profession, and as they are somewhat prejudiced towards me, you would confer a favor in stating which way is best of constructing beams supported on iron columns, viz.:

The first method would be to get beams of 14″ x 12″ of 36.0 feet length. The second, to get them in 18.0′ long. The third, to make them of 3″ joists bolted together with alternate joints. In all cases to bear a floor for a public edifice.

If you think the thing proper, please give an answer in your nearest issue of the *American Architect*, and oblige,

Your obedient servant, X.

[The third method would, we think, be the strongest, with beams 36 feet long, breaking joint and thoroughly bolted. Next to this, the first method would be the best. — Eds. American Architect.]

ARCHITECTS SHOULD CONSULT SPECIALISTS.

New York, October 4, 1887.

To the Editors of the American Architect: —

Dear Sirs, — Referring to the editorial comments in your last issue on the subject of heating and ventilating buildings, it seems to me that even in those [too rare] cases in which architects have some true knowledge of these matters, it is to their own and to their clients' interest to consult and be guided by the advice of professional engineers [not contractors], who make this work their specialty. To decide correctly on the most economical and best generation and distribution of steam, the most economical and effective flow of air, ventilation, and the like, and to devise the best system in any particular case, demands a special knowledge and experience, which can, as a rule, only be possessed by the trained engineer, who has devoted years of study and practice to this department of work. It is certainly preferable to put faith in the unbiased, experienced engineer than to rely, as is so frequently done by architects, on the [one might also say *necessarily*] biased contractor. Alfred R. Wolff.

TIN *VS.* GALVANIZED-IRON FOR ROOFS.

Ashland, Wis., October 5, 1887.

To the Editors of the American Architect: —

Dear Sirs, — Will you kindly give your opinion regarding which would make the best and most-lasting roof for a building with the pitch as low as ½″ to 1′; one covered with galvanized-iron No. 26, with standing seam, or one covered with I C roofing tin with locked and soldered joints? It is claimed here that contraction and expansion will make the galvanized-iron crack in a short time. As there are divers opinions regarding it, I would be pleased to have yours. Respectfully yours, W. H. W.

[We should much prefer the tin roof. — Eds. American Architect.]

NOTES AND CLIPPINGS

How Mirrors are made. — One of the factories in Chicago employs some one hundred and fifty men and boys, and its spacious four floors present an interesting series of sights to the visitors whose nerves are steel and tympana proof against splitting. On the first floor he will see huge stacks and piles of glass in assorted sizes, ranging from sixteen feet by seven feet squares down to the smallest ovals for mirrors. These are all polished, some being run over huge felt-colored wheels kept powdered with rouge, and the larger sheets scrubbed by sweating toilers with hand-blocks covered with felt, like a printer's proof-planer in rouge. After the glass is thoroughly polished it is taken up to the next floor, where it is laid on tables and cut into the sizes ordered. It then passes into the hands of the bevellers, who, with

sand and water and large grindstones, artistically finish the edges of the glass. It takes a trip upward again, to another floor, and is once more put through a polishing process to remove any scratches or blemishes that may be on the glass. After every spot or scratch, no matter how minute, has been removed, careful hands convey the now beautiful and sparkling glass to the room where it goes through the final process, the silvering. Huge tables of cast-iron or stone, made like billiard tables, with raised edges, are used in the silvering-room. These tables are of great strength and solidity, and all around the edge is a drain, for the superfluous mercury is poured over the tables in quantities sufficient to float the glass, which, after being tinfoiled, is gently and carefully pushed across the table containing the mercury. Great care must be used to prevent blemishes, the least speck of dust being ruinous to the mirror. Mercury, like molten lead, is always covered with a dirty-looking scum which cannot be removed by skimming. The least bit of this scum would spoil the mirror, so the difficulty is obviated by shoving the scum along with the edge of the glass. After successfully floating the glass on the mercury, a woollen cloth is spread over the whole surface and square iron weights are applied until the whole presents a compact mass of iron, two or three pounds to the square inch. After this pressure has been confined for ten or twelve hours, the weights are removed and the glass placed upon another table of wood with a slightly-inclined top. The inclination is gradually increased until the unamalgamated quicksilver had drained away, and only the perfect amalgam remains, coating the glass and perfectly adherent. This ends the process, and the erstwhile rough piece of plate-glass emerges from the silvering-room a gorgeous mirror. — *Western Manufacturer.*

New Uses for Wood Pulp. — In the article on wood-pulp pails, in *Engineering*, July 1, page 21, allusion was made to only a few of the uses to which this form of wood pulp has been applied. That specific method of manufacture and subsequent treatment has been used in the production of piping, which is screwed into iron couplings. Such pipe has been shown to be unusually adapted for conveying anything not of high temperature or strongly alkaline; it is impervious to leakage or attacks from anything in the earth in cities, and is especially suited for water-pipes, illuminating and natural gas, while recent investigations upon its electrical conductivity have encouraged its promoters in offering it as the ideal material for tubes or conduits for underground electrical wires, which is at present a disturbing element in the local self-government of American cities. It is also used for storage and galvanic-battery jars, and also for a great number of domestic utensils. Other forms of wood pulp have been fashioned into boards for construction of dwelling-houses, and special forms of such paper is made into hard sheets for roof coverings which are exceedingly durable and very light, weighing only one-half pound to the square foot, or about one-tenth that of slate and one-fifth as much as shingles, and far less than any other form of roofing. Such coverings, although easily combustible, are rendered almost fireproof by covering both sides with a coat of paint made from iron ores. The sheets are laid with great rapidity, beginning at the top and working towards the lower part of the roof, securing them by nails driven through tinned iron washers about an inch in diameter. Such coverings have been tried on a missionary station in Siberia, where the white ants destroy almost everything, and it was found that the oil treatment did not commend itself to the omniverous appetite of these tropical pests. — *Engineering.*

Blast-furnace Slag no longer a By-Product. — Blast-furnace slag has been in the past as complete a waste as any by-product in manufactures, but the next five years will probably see it playing as important a part in the profits of iron furnaces as by-products do in gas works. The basic slags, with a large percentage of phosphorus, are already profitably used in the manufacture of phosphatic manures, and other slags have been for some time converted into what is known as "mineral wool," of use in building as a non-conductor. The next step taken is to turn this "wool" into the raw material for the manufacture of glass and porcelain, cheaper than sand or clay, and offering color combinations of great beauty. The first step in this process was taken four years ago, and the *Engineering and Mining Journal* expresses the opinion that "when our iron markets shall have fallen to the unprofitable figures which they have witnessed in the past, and that are surely approaching in the future, our blast-furnace owners will find the value conferred upon the slags by this improvement to be no inconsiderable item." — *Philadelphia Press.*

The First Inventor of the Lightning-rod. — If we are to believe an Austrian paper, says *La Lumière Electrique*, the first lightning-rod was not constructed by Franklin, but by a monk of Seuftenberg, in Bohemia, named Prohop Diwisch, who installed an apparatus the 15th of June, 1754, in the garden of the curate of Prenditz, Moravia. The apparatus was composed of a pole surmounted by an iron rod supporting twelve curved-up branches, and terminating in as many metallic boxes, filled with iron ore and closed by a box-wood cover, traversed by twenty-seven sharp iron points, which plunged at their base in the ore. All the system was united to the earth by a large chain. The enemies of Diwisch, jealous of his success at the court of Vienna, excited the peasants of the locality against him, and under the pretext that his lightning-rod was the cause of great drought, they made him take down the rod which he had utilized for six years. What is most curious is the form of this first lightning-rod, which was of multiple points, like the one which M. Melseu afterward invented. — *Fire and Water.*

TRADE SURVEYS

It is an unusual time in the year to speak of an improving tendency in real estate, yet upon the testimony of very reliable operators, and of some architects and builders, such a statement can be made. It might be thought that with all the conserving influences which have been at work during the past month or two, that real-estate operations would be more guarded. The transfers are numerous, and a large percentage of them, for larger than usual amounts. It is to be noticed that a great deal of real estate in the larger cities and towns is changing hands. There seems to be a growing demand for city sites, and those who have a keen eye for the future are securing desirable localities in advance. It is regarded as a good investment to purchase unimproved city property at present valuations. It is reasonable to expect this improvement, when the conditions are carefully viewed. The population of all our large cities is increasing; manufacturing is expanding; the volume of business is increasing, and a suburban population is growing — all of which have a reflex influence upon city property, improved and unimproved. This buying-up of property is going on in nearly all of the larger cities North and South. Many of the purchases are being made for building purposes — work to be begun next spring. In Chicago, St. Louis, St. Paul, and some of the newer cities farther West, there is an improvement in both city and suburban property, which promises to be continuous. The large cities will no doubt grow larger, and within five years unimproved property, which can now be purchased at from one hundred to a thousand dollars per acre, will be worth ten times those figures. Local capitalists are operating in this direction, and see in it better and safer opportunities than in any other. The only point in referring to this tendency is, to gather from it the evidence or proof of the statement that building activity next year will be no less than this. The contrary statement has been made by some high authorities; this factor in the problem has been overlooked. All of the staple products are in active demand. Iron, steel, wool, cotton, petroleum, are all selling well, and are being protected by trade and other combinations which, perhaps, may be growing too fast, and gaining too much control for the best good of the greatest number. The circumstances of the country invite powerful trade combinations, and they will, no doubt, grow in number and control until the element of evil within them generates the necessary reactionary influences to overturn them or to limit their activities. There is a growing apprehension in the public mind against these combinations, and combinations of any kind designed to control or restrict the natural law of competition; but these influences are natural in trade and manufacturing. Every combination of capital or of enterprise must have within itself a self-asserting power, and these combinations are the visible evidences of it. So far, they have done but little harm; but the public sentiment which is being aroused against them will no doubt exert a healthful influence in restraining a too-grasping policy. The steel-rail makers who combined a year and a half ago and advanced prices from $26 to $42, are now glad to sell at $35, and it is intimated that they will be glad to sell at a dollar or two less per ton before the opening of the year. The iron-makers generally are crowded with orders, but not to such an extent as to enable them to advance prices a farthing. The textile manufacturers throughout New England have been encouraged by the declaring of encouraging dividends, and numerous combinations and enlargements have been resolved upon, which justify the conclusion that industry is gaining ground. The fact that two-thirds of the loom capacity of the country is practically sold up to production may be regarded as the strongest kind of testimony as to the prosperous condition of that mighty industry. The progress made in the Southern States is in the direction of the cheaper and coarser grades. That tendency has done more to stimulate capacity in the North to push out into higher textile fields than anything else. The effect, in the long run, will be that the competition which a year or two ago was foolishly feared, will result in the production of grades and qualities of goods which will drive out or check importations which now imagine themselves to be upon a firm footing. The manufacturers of all kinds of electric, motive, and wind-mill power continue to book a great deal of business for next winter and spring. It is to be regretted that there are no means for ascertaining the actual progress made in this important field. All of the great machinery-making establishments are greatly over-crowded with orders, and within the last three months, the orders for export have gone very far ahead of all previous years. In fact, the record which American machinery-makers are establishing in foreign countries is bringing, and will continue to bring an increasing volume of business. It is comforting to turn over the pages of our national day-book and read the day-by-day increasing totals of business, and note the evidences of expanding activity; but it is well, at the same time, to keep in mind that the foundations of this prosperity can be shaken or weakened by a defective financial policy, if not by a defective fiscal system. The more or less intelligent consideration which these questions are receiving is encouraging, and points to the probable favorable solution of them. Yet the country is in need of more wisdom in high places than has yet been made manifest. No doubt, if a crisis ever occurs, the times will produce the men who will guide the country safely out of it, as has ever been the case in our past history. A wiser financial system is needed; but it will come only when circumstances crowd it upon us, after the manner that all great reforms and great steps in progress have been made. The facts concerning recent market and trade developments may be very briefly enumerated. The export trade is heavy. Gold is filtering to this side; the great West is absorbing increasing quantities of Eastern products, in anticipation of winter wants. Large Eastern supplies which have been accumulating since late summer are being depleted rapidly. Jobbers and travelling agents are full of business. Manufacturers, big and little, are busy. Shop-capacity everywhere is well employed. Railroad building is being crowded ahead almost as rapidly as in our phenomenal years. A great deal of new work is hanging fire. Much capital is slipping southward into new and inviting fields. Financiers are saying "Beware!" But this apparently extraordinary activity is becoming our normal business condition. Material manufacturers are preparing for a large increase in production. Both wire and cut-nail makers are increasing their output, in spite of discouraging trade conditions. Tool and implement makers, and the producers of machine-shop supplies, have had an exceptionally good season since September 1. A great many new industries are taking root, as is shown by the increasing number of companies being formed throughout the country. This is a year favorable to men of small capital. The greater corporations which, a few years ago, overpowered the lesser, are not now as able to cover all the corners of the widening field as then. The secret of this fact is, that the population of the country is spreading into the new region west of the Mississippi, and as new communities spring up new sources of supply must spring up near them, and large investments of capital are impossible under such circumstances. The workingmen of the country are looking more anxiously towards what can be accomplished by legislative or political action than by strikes. A few anthracite miners are vainly trying to secure better terms from their employers. The coke-makers have been unable to come to terms. The iron-workers are quiet. The building trades are crowded with work. The tool-makers and all machine-shop labor were never more busily employed. Employers generally are standing together with greater mutual confidence, even though where they are not united in actual organization. The fear which overtook so many of them a year or two ago at the threatening attitude of labor has subsided.

THE AMERICAN ARCHITECT AND BUILDING NEWS.

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CONTENTS

THE brightening prospect of the hanging of the Chicago dynamiters, together with the occurrence of the Knights of Labor Convention at Minneapolis, have kept the readjusters of society in a fever of enthusiasm and bad logic for some time past. Of course, the Knights of Labor themselves, being more given to the simple art of getting regularly through their week's work, and collecting their pay at the end of it, than to inventing statistics and clamoring about the dignity of man, have not contributed much to the discussion, leaving this to the officials whom they hire to do their oratory for them; but the latter have shown commendable zeal in their duties, and, joining their voices to those of the professional enemies of law and order, have made the past week or two rather noisy. The most remarkable incident has certainly been the holding of a meeting of Socialists, under the presidency, we believe, of that consummate artist, Mr. William Morris, to protest against the execution of the Chicago assassins, on the ground, as they stated in their resolutions, that these unfortunate creatures were "attacked by the police, and murdered the latter only in self-defence."

THIS way of looking at the subject indicates that the Socialist methods of reasoning, and habits in regard to telling the truth, are the same in England as on this side of the water. We should be far from suspecting Mr. Morris of anything but the sincerest aspirations for human happiness; but when we find him making himself responsible for a statement that people who had for months been secretly engaged in making bombs to throw at innocent persons, who appointed a certain day for using them, met on that day, took stations assigned to them and threw the bombs according to programme before any attack was made upon them, were acting in self-defence, we cannot help wishing that his inductive faculties had been a little better developed, even at the expense of his imagination. As commonly happens in such cases, the appearance of a man deservedly honored by the world at the head of a meeting of this kind has stirred up a multitude of imitators, resembling Mr. Morris more in their style of logic than in their reputation as artists or poets, who have inflicted on their hearers some of the worst nonsense ever uttered. One of this tribe recently, after the usual dark references to the approaching destruction of the social fabric, wound up by declaring the purpose of the Socialists whom he represented to be the abolition of all authority, and the constitution of every man "a law unto himself." When this change, which he thought would need the aid of dynamite, was accomplished, the speaker considered that the Socialists' millennium would have come. Unfortunately, he did not enter into as much detail as would be desirable about the way in which the régime of universal liberty could be carried on. If the abolition of authority were entirely untried, the Socialists' dreams of what would be the consequence of it would be as good as any one else's dreams; but, as it happens, the system has been put in practice thousands of times, always with the same result. No sooner does every one become a law unto himself than two or three persons' laws become incompatible. One individual makes a law that he must appropriate certain objects which please him. Another individual, who has been at the trouble of collecting the objects, has already established a law that he shall keep them himself. Then the two law-makers come in collision, and the statutes of the one who hits hardest prevail. The prospect of this result of the establishment of their system does not disturb the Socialists in the least, because they reckon, by dint of conspiracies, organization, secret arming and dynamite bombs, on being the strongest when the matching of laws begins, and, in consequence, of subjecting every one else's ideas of property and decency to their own; but it has a certain interest for those who do not wish to see some time a crowd of savages with nitro-glycerine bombs in their hands trampling on every notion of honor and purity which the decent world holds sacred. It does not require very deep thought to see that the whole course of civilization has been in the direction of adjusting the self-established laws of different persons to each other, so as to preserve the utmost possible amount of liberty to each. A thousand years ago the Socialists' idea of liberty was generally accepted. There were no policemen, no authority, no general laws. Every one was a law unto himself; and the ground was strewn with the corpses of women, whose laws differed from those of the armed barbarians whom they met, and of the young and feeble, who were so misguided as to have made it a part of their law to try to keep for themselves what a stronger savage wanted. By degrees, a decline from the Socialist principles set in. Public statutes, the abhorred product of the civilization of "capitalists" and "bourgeois," were established, under which the weak and innocent were to be permitted to enjoy what they had, and to go about their affairs without molestation, and policemen, the hated representatives of peace and order, were appointed to see that the statutes were carried out. Up to the present time, by the help of improvements in the general laws, and increase in the efficiency of police administration, the world has, as a rule, been steadily approaching the condition of perfect liberty, when every one, however weak, shall be able to manage his affairs just as he wishes, so long as he does not interfere with some one else's equal right to pursue a similar course. Much still remains to be done, before all possibility of deceiving or frightening any person into doing what he would not do, if perfectly free to act, is removed, and men who have ability enough to help in the work of reform, and the disposition to do so, are so much needed that it is all the more unfortunate that a man like Morris should allow himself to be used by the plotters of anarchy, the enemies of every one else's liberty except their own.

THE energies of the Knights of Labor, in convention assembled, were, fortunately, directed in the main to discussion of peaceful themes, although some fiery souls attempted to attach the order to the tail of the small organization of Socialists, on the theory, perhaps, that the unceasing noise kept up by the latter would be a fair equivalent for the numbers and influence which the Brotherhood would bring to the union. As it happens, however, Mr. Powderly, aside from his natural good sense and good feeling, is, as the possessor of an income of five thousand dollars a year, less alive to the importance of an immediate redistribution of wealth than he was a few years ago; and having been offered, according to report, a salary of fifteen thousand dollars whenever he is ready to accept it, it is less surprising to find him denouncing "the bestowing of wealth on those who have not earned it" as "robbery and rapine." There are, undoubtedly, many of the Knights who would gladly see their three dollars a day equalized with Mr. Powderly's fourteen; but they thought it best to keep quiet, and the Convention seems to have given a substantial impulse to the growth of common sense among those who at present work for smaller

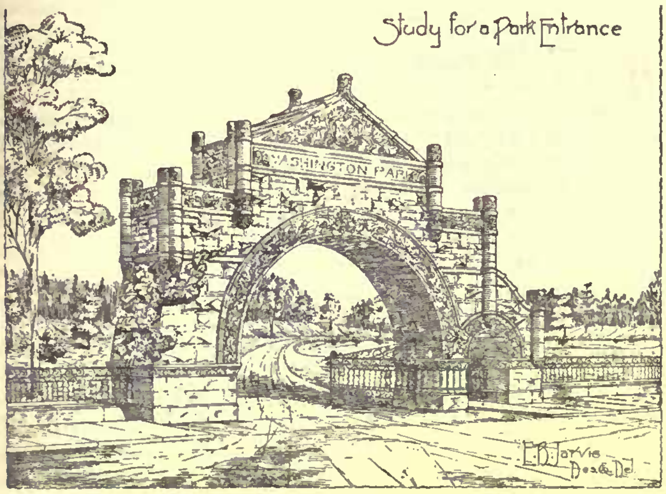
wages than they would like. The most important criticism to be made upon the proceedings would attach, we should say, to the statistics presented by the Secretary. We need hardly say that experience has not shown extraordinary accuracy in the records kept at the Palace of Labor, and, in fact, when quarrels occurred between the central government and local organizations the facts and figures with which both sides rushed into print showed not only a ludicrous discrepancy between statistics, purporting to be prepared with extreme accuracy, in regard to the same local Assembly, but presented indications of having been prepared by the sort of inspiration, or general impression, or "estimate," which furnishes so many of the data used by orators. The figures furnished the Convention ought, considering the importance of the occasion, and the time allowed for careful computation, to have been perfectly accurate, but immediately upon the publication of the Secretary's report, showing a membership of about four hundred and fifty thousand, of which, according to the Secretary, only fifty thousand were in unfavorable standing from having neglected to pay their dues, some arithmetician remarked that the report of the local Assembly of Massachusetts reported forty-nine thousand delinquents in that State alone, and asked, not without reason, why the Massachusetts climate should be so unfavorable to knightly sentiments as to cause forty-nine times as many cases of broken vows there as in all the rest of the United States put together.

THE work of constructing the enormous building for the Congressional Library at Washington has been begun very quietly, but is going on in a very satisfactory manner, and the foundation will probably be ready for the superstructure when active operations recommence in the spring. In the excellect little report of progress which the architect, Mr. Smithmeyer, submits to the Secretary of the Interior, he gives an instructive comparison of the dimensions of various public buildings in and out of Washington. According to this, the library will cover an area of one hundred and eleven thousand square feet, or more than two acres and a half. The nearest public building to this, in point of size, which has been erected of late years, is the German Parliament House, which covers one hundred and ten thousand feet. The Library of the British Museum occupies ninety-seven thousand, and the Royal Library in Munich ninety-nine thousand square feet, so that Washington will boast the greatest building of the kind in the world. In Washington itself, the only larger structure is the Capitol, which, including all its projections, covers more ground, although the main body, consisting of the rotunda and the two wings, occupies a much smaller area than the Library. As Mr. Smithmeyer justly says, in a building of such magnitude every step must be carefully considered, and he has certainly taken extraordinary pains to begin the work well. His method of testing the resistance of the ground, as described in the report, deserves particularly to be commended to young architects. While the excavation was going on, borings were made at different points, to determine the character of the subsoil, and a line of made ground, occupying the bed of an old water-course, discovered and mapped out for the provision of special foundations. At the same time, the resistance of the ground in the bottom of the trenches to vertical pressure was tested by a travelling car moving along the trenches, and halted at intervals in such a way as to bring the whole weight of the car and its load upon four cast-iron pedestals, each measuring one square foot at the base, and set four feet apart each way. The car was loaded with pig-lead, and the resistance of the soil in the bottom of the trenches, a yellow clay mixed with sand, was found to be generally about thirteen and one-half tons to the square foot. As the maximum weight on the subsoil will not exceed two and one-half tons to the square foot, the tests gave decisive evidence of what many architects think to be a matter of luck—that no settlement of the ground under the building is to be feared. We need hardly say that this is the only proper way to carry on important constructions, and Mr. Smithmeyer, who is the only private architect who has been employed by the Government for many years on work of such magnitude, deserves the thanks of the profession for the credit which he casts on it by his care and science in carrying out his commission. Some idea of the magnitude of the work may be obtained from the fact that the contracts for excavation alone amounted to nearly twenty thousand dollars, while the concrete footings will cost about seventy-five thousand.

A CURIOUS occurrence took place in New York lately, of which we have many different, not to say conflicting accounts from the daily papers. A large apartment-house, known as Holbrook Hall, stands on the corner of Fourth Avenue and Sixty-second Street, and is occupied by a large number of tenants. The structure was originally built by a syndicate, with money furnished on mortgage by the New York Life Insurance Company. Before its completion the syndicate, like so many others who invested money in apartment-houses a few years ago, fell into difficulties, and the insurance company foreclosed its mortgage and took the building. With characteristic thoroughness, the company proceeded to examine its new property, make good everything defective, and complete it in the best manner. A large amount of money was spent in strengthening the foundations, and in order to make the floors practically fireproof, and thus avoid the greatest objection to apartment-house life, the beams, most of which were of hemlock, three inches by eight, were laid nearly in contact with each other, being separated only by a slip of felt paper, and spiked together. The under side was then wire-lathed and plastered, and the top deafened, first with a coating of hot pitch and then with an inch and a half of concrete, and an upper floor nailed on over the whole. One account says that this work was done under the direction of Mr. William E. Worthen, a civil engineer of high reputation in New York, who has had much experience in building. However this may be, the hemlock beams shut in between the plastered ceiling, the felt paper and the upper coating of pitch and concrete, soon began to rot, and settlements made their appearance. These were at first attributed to some want of thoroughness in repairing the original defects in the foundation, but a small fire broke out in the building a few weeks ago, owing to the undue proximity of some floor timbers to the underside of a hearth, and the present architects to the company, Messrs. McKim, Mead & White, in looking after the repairs, discovered that the beams exposed during the operations were penetrated by dry-rot. Further investigations followed, showing that the whole of the solid hemlock floors had become so soft, in less than three years after they were put in, that the beams could be shovelled away. The architects promptly warned the insurance company that the building was in their opinion dangerous, and the officers of the company immediately notified the tenants to leave the house before night, promising to pay their hotel bills for the next twenty-four hours, together with other necessary expenses of moving. A notice was at the same time posted at the doors, warning all persons wishing to enter that they did so at their peril, and a guard was set to prevent people from passing on the side of the street next the building. Of course the infected floors must be removed, and the work of replacing them with others is likely to be costly, but it will probably be done in the most efficient manner. A few of the floors were of spruce, and these, as might be expected, had resisted the rot much better than the hemlock, and were still sound, but the construction ought certainly to be changed. In view of the dangers from this source which attend efforts to provide fire-resisting floors of wood, it would seem that something might be done with light shapes of rolled-iron beams. We have seen rolled floor-beams used in Paris nearly as light as wooden ones of the same depth, and a tier of these, deafened with mortar on wire in the French manner, and wire-lathed underneath, with a wooden floor over, would cost little more than a solid mass of wooden beams, and would be proof against rot as well as fire.

A GREAT competition, open to all the world, is announced in South America, where the Republic of Buenos Ayres has determined to erect a vast Capitol building, and invites designs from architects. So far, the details published are rather meagre, but, as we understand, the representatives of the Republic of Buenos Ayres, have received instructions to furnish information to intending competitors, and, as the highest premium offered is said to be forty thousand dollars, it is evident that the Government of the Republic desires to secure the best design possible. The date set for submitting drawings is in April next, so that no time is to be lost by those who are disposed to take part in the contest.

A DAY IN QUEBEC.



NEVER was there a greater mistake than taking this trip to Quebec so hurriedly and without warning; it would seem as if any half-educated person would know better; would be more conscious of the eternal proprieties than, without proper study and preparation, to thrust his ignorant curiosity into the midst of surroundings whose smallest part savors of history, real and legendary: Indian legend, French romance and English history, history Canadian and, above all, American history, for one of the keenest pleasures the place affords is the sensation that this spot is American; that the landscape, with its autumnal glories in their height, is such as can be seen only on the American continent; and, while gazing at the varied views, far-stretching and dissimilar on one side and the other, with broad reaches of water and hillsides both rugged and those which lure the climber through promise of much reward for little toil, one forgets political distinctions between Canadian and Yankee, and feels at once at home, and yet, when the eye leaves the work of nature and seeks that which man's hands have produced, the feeling of being a stranger in a foreign country is overpowering.

The place is rich in sensations and impressions.

HERE
DIED
WOLFE
VICTORIOUS
SEPT. 13,
1759.

strikes the reader as he stands beside the lonely column on the verge of the Plains of Abraham as the most impressive epitaph chisel ever graved. Its very simplicity is the embodiment of solemnity. Its brevity tells a longer tale than would many and high-sounding words. Its lack of title or particulars of any kind is the most flattering tribute that great achievement could seek at the hands of posterity. It quietly sets aside the possibility that any one in any age might ask "Who was Wolfe, and what did he do?" It is a noble and a fitting record, and perhaps helps to keep his memory green — fresher than that of any soldier that ever died on American soil. The inhabitants have a way of speaking of him as of a man they had themselves known, in whose exploits they had a personal share, whose fame sheds a reflected glory on all.

No, it does not do to visit Quebec without first refreshing the memory as to some of the events in its history and the particulars of the histories of the men whose thread of life has been severed at one point or another of America's most famous battlefield. If one would be spared the humiliation of wondering who Montgomery was — when the house where that really illustrious American general breathed his last is pointed out, he must have skimmed through a guide-book at least, and not trust to inspiration and the long-forgotten studies of his school days. A proper course of investigation might possibly mitigate the surprise with which he would encounter in the charming little village of Beauport, near by, the life-size and animated wooden statue of a French colonel, who, in all the glory of freshly-painted coat of gray with white facings, cocked hat and plume, curling black whiskers, polished boots and waving sword, is advancing with vigorous step upon the main door of the Church of Nôtre Dame just across the footpath. The driver called him Colonel Sellière — or some such name, but for want of previous perusal of guide-books the gentleman could not be historically placed. Evidently, the painters who had been decorating the interior of the church with some $50,000 worth of their handiwork — and very creditable work it was, too — had conceived that this military personage would winter more comfortably if he were furnished with a thicker coat and had acted accordingly. The statue was not half a bad one, but being placed *à plein pied*, without a pedestal, and seemingly bursting his way through the tall and tangled grass in his eagerness to get at the priest, perhaps, the effect was somewhat provocative of laughter. But all the same, one does not encounter such memorials as this in non-historic towns.

St. Augustine and Quebec are the only fortified towns in this country where the help of the real military engineer was brought into play, and in both places the fortifications are amongst the most attractive points of interest, yet, as one looks at Quebec, with its natural advantages reënforced by the works of the engineer, and reflects how small a spot this is compared with all the vast country around, the utter absurdity of wars and conquests is very suggestively presented, and the audacious claim of the handful of men that could be gathered there in pretending to hold the vast outer territory in subjection, while there were a thousand other points which other groups of men could occupy in the same way without interfering with the actual living rights of any other group, finds a perfect parallel in the practice of pugillists and oarsmen who give themselves out as "champions" of this or that, and feel that they are so simply because a stronger or better man does not take the trouble to convince them that they are not.

The lower gates having been done away with, the visitor does not realize that in mounting the hill from the steamboat landing he has passed within the walls, and when, not long after, he comes to the gates rebuilt by Lord Dufferin, he imagines that at length he is entering the stronghold, but on looking back at the view finds that if the embrasures were filled with cannon they would be pointing at him, and that he has already passed through and beyond the fortifications. The real esteem in which the present inhabitant regards these fortifications is betokened by the doing away with the lower gates and the building of the new Houses of Parliament just outside the walls. The site chosen for this building is a commanding one — almost or quite the highest spot in the city; but the building suffers for want of space about it — space which could not be easily obtained, for just here are three roads of equal importance passing out of the city by three gates, not more than two hundred yards apart, and advancing into the country in nearly parallel lines. Between two of these roads lies the Parliament House with a side façade abutting upon each. The ground in front is approximately a square, with sides of the length of the main front of the building — obviously too small an area to furnish proper setting for so large a building. So excellent a design was worthy of all the embellishment that the landscape architect could give it, but it seems hopeless to expect that anything will be done that will be of much avail. One thing could be carried out which would probably prove effective: while the building stands on perhaps the highest spot in the city the land falls away more abruptly toward the road that passes it on the west side, and if the main approach to the building were to be over this road and the ground properly terraced, and broad flights of steps, half the length of the front, built up from below, an effect would be gained which would be in consonance with the general type of the surface of the island. But now the building is nothing other than would be built in any flat country, and so seems a little tame and out of key with its surroundings. For all this, taken by itself, it is one that gives much pleasure to the beholder, as there is a general air of elegance and refin ment about it bespeaking the work of one trained in French rather than English schools. To confess that no attempt was made to see the building from every side, nor yet to discover whether the internal treatment was as praiseworthy as the exterior does not imply lack of interest or energy, but only shows how potent was the feeling that the city contained enough of things unique to fill all the scanty hours at command without spending any of them on an object which, however good in itself, might be as appropriately placed in Omaha as in Quebec. The desire to be penetrated by the spirit of the place as a whole stood in the way of spending time in a conscientious architectural examination of the many other buildings of interest.

Descriptions of any particular building can be found in the guide-books in quite as reliable and interesting form as it would be possible to give them here. It was pleasure enough to drive about the town without definite itinerary, turning down one street or another according as the first glance seemed to promise something of interest; now driving down a hill so precipitous that the carriage threatened to turn a somersault over the horse's back, the skilful descent of which won respect both for the surefootedness of the beast and the soundness of his harness; now winding about through the lower part of the town, destroyed by fire some six years ago, but still having an air of picturesqueness in spite of the buildings being little more than one and two-story, flat-roofed brick boxes of perhaps four rooms each; now taking a turn along the water-front on the other side of the town, where the ocean-liners and some few vessels give the place quite a maritime air, while the little French corvette in the roadstead, with its white-painted guns, cream-colored hull, and white-clad sailors, give the place a gala air and remind one that the French sailor is considered by his English brother rather a fair-weather creature when all is said. From this lower level to the rampart above runs the inclined railway, or rather, elevator, which makes trips every few minutes, and which is a most popular contrivance.

Building material of all kinds, save iron and terra-cotta, are used in the most catholic manner: stone, brick and wooden buildings stand cheek by jowl and have a home-like air, vastly different from the melancholy formalism of Montreal. The stone used is of several kinds and colors, the most common a whitish limestone about the color of Concord granite. Other than this the most noticeable material was an exceedingly agreeable dark green limestone, too solid in color to be called serpentine, of which was built the large jail just beside Wolfe's monument. It had just enough color to seem to be

an integral part of the landscape, to be an outgrowth of the soil itself, and not an imposition upon it.

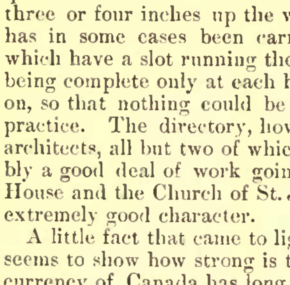
Here, again, the charming effect that, at certain stages of its existence, an unpainted tin roof may give to a spire or a dome could be noted in every direction; it seemed altogether a noble metal, and its modest sheen was quite superior to the bold effrontry of the gilded saints and crosses that crowned some of the buildings. Attention being called in this way to the tin roofs, it could not escape notice that the local method of laying a tin roof was peculiar; the plates were laid with a simple locked joint without solder, and were laid in inclined courses, the angle of inclination seeming to approximate the pitch of the roof, though on some steep roofs the inclination was certainly less than the pitch. However tight a roof this manner of laying the plates may give, it certainly produces a very ugly effect, as the whole roof covering has the air of sliding with more or less rapidity into the street. From the terraces and the Place d'Armes there is an admirable chance to study the roofs in the lower town, which lie just below and wisely have no glazed skylights to irresistibly tempt the small boy to drop missiles upon them. Whether he abstain from throwing things down the yawning and unprotected chimney flues may be doubted. From this point could also be discovered another local custom, which may be enforced by law or advocated only by experience; against almost every chimney was reared a wooden ladder, while another ladder led from it to the scuttle or to the eaves for the use of the home fire-brigade. The only other local peculiarity noticed, for naturally a lookout was kept for any device which had been found useful in this northern latitude, was the treatment of the down-spouts. The inevitable is frankly accepted; water will freeze, cause a bursting of choked conductors and when the thaw comes do damage which is as likely to befall the walls of the house as the clothes and person of the unwary wayfarer. Like prudent souls, the inhabitants prefer that their house walls shall be kept as dry as possible, and consider that it is their neighbor's affair to take care of himself as he passes their houses; and as the best relief the circumstances afford and the best protection they can give their own walls, they use iron conductors with holes about quarter of an inch in diameter drilled in the front of the pipe every three or four inches up the whole length of the pipe. The system has in some cases been carried farther, and some pipes are used which have a slot running the full length of each joint, the cylinder being complete only at each hub. Little building seemed to be going on, so that nothing could be noted as to local methods of building practice. The directory, however, contains the names of thirteen architects, all but two of which were French, so that there is probably a good deal of work going on and — judging by the Parliament House and the Church of St. John the Baptist, just rebuilt — work of extremely good character.

A little fact that came to light in answer to a question about taxes seems to show how strong is the tendency to cherish tradition. The currency of Canada has long been one of dollars and cents, and no one thinks of naming a price in any other terms, but taxes are still assessed in pounds and pence.

If any one has any misgiving as to whether his nature fits him to enjoy and profit by a trip to Europe, let him take fifty dollars and spend a week at Quebec. If he finds enjoyment and feels enthusiasm there, he can safely spend the larger sum a European trip requires; but if he finds it dull, perfunctory work, and cannot see what there is to admire or amuse in crooked buildings, steep and narrow streets and an unintelligible *patois* that cannot be found in the slums of his own neighborhood, let him stay at home.

Quebec and its surroundings is a memory that will not lose lustre as time passes, even if one has seen Edinburgh, Gibraltar, Ehrenbreitstein or any of the famous European places which belong to the same general class.

THEATRE FIRES.



A ROMAN FRAGMENT — The Museum at Dijon.

THE recent object-lessons taught at the expense of our neighbors across the sea ought not to fade out of mind without some of the gain to us that results indirectly from railroad and other accidents; and if we learn aright they may be of more advantage than similar occurrences in our own community which are too often followed by that hasty and ill-considered action, aptly termed "panic legislation." Our local legislation, on technical matters especially, is bungling at the best, and needs very careful guidance to result in permanent advantage. Ill-considered law is seldom rigidly enforced.

Boston has a Building Act (passed since most of the theatres in that vicinity were built and, of course, not retroactive), which, if strictly and intelligently enforced, will render new theatres secure against rapid combustion; and, what is more to the purpose, so controls their arrangement and some of the details of their use as to facilitate the escape of the people before and behind the curtain in event of fire.

The law is not stringent enough for absolute safety even though enforced to the letter. After years of persistent effort it proved to be the best that could be wrung from our law-makers in the face of ignorant or interested opposition. With the very best construction that its terms compel there would remain a considerable element of danger, besides the danger of unreasoning panic. Some causes of this latter peril are removed by the present regulations, which should be further extended; but the blind madness that endangers crowds in an open plain will always endanger them more when confined within walls. Let our consideration, then, be confined for the present to risks that are wholly removable by proper construction and control; and the foremost and most formidable of these are not in the very limited number of structures to be erected under the present law, but in the many that already exist, to which its rules have never applied. In these should be ordered such radical changes of construction and arrangement, and such regulation of their daily use as are known to be absolutely necessary to the reasonable safety of their patrons. In case of refusal or neglect to make such changes the license of the offending party should be revoked and the house closed. And this involves no uncalled-for or unnecessary severity. Railroad owners and others are put to great expense in order to increase the safety of travellers, and the patron of theatrical entertainment is certainly entitled to reasonable security in return for the very high price he often pays for a very inferior entertainment.

The theatres that have recently been burned abroad were not exceptionally inferior in their arrangement or construction. They were undoubtedly defective, but their worst defects could be paralleled in Boston, and our general average of safety is much lower. Both the Paris Opéra Comique and the English Exeter Theatre were of what might be called fire-resisting construction, if nothing better. The former stood in an open square and the latter had three sides on streets. The Opera House at Nice and the Ring Theatre also stood detached, or practically so. There are few theatres in America so safe in this respect. In all the main causes of loss of life were similar, an excessive accumulation of combustible scenery and machinery on the stage; gas for lighting — dangerous while in use and turned off in exits when most needed; ill-arranged or insufficient exits, made worse by temporary obstructions or locked doors; and, added to all, the human agency; the things left undone that ought to have been done, and done that ought not to have been done; and then panic.

The vital point of danger is the accumulation of light woodwork, cordage, gauze borders and draperies, and properties on the stage, in connection with distributed gas-lights with movable fittings and the consequent inevitable gas leakage. The law should utterly prohibit the use of gas under such conditions, no matter what the expense or illuminating quality of the substitute. No scenery nor properties nor temporary machinery should be kept on the stage except for immediate use; and all scenery and machinery should be made uninflammable. This would lead at first to considerable expense and some inconvenience. But it can and must be done, and no questions of cost are worth consideration in the face of such chances.

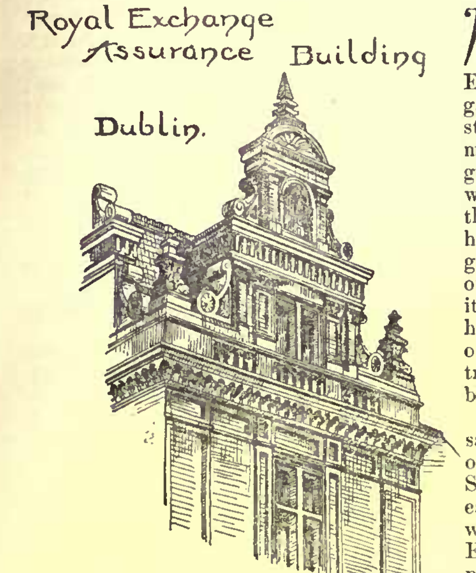
The smoke from a full stage conflagration may be pretty surely counted on to suffocate all in the upper gallery in ten minutes after it breaks fairly through the proscenium opening. In auditoriums of small area and considerable height, and with high proscenium openings and crowded stages, it might do its work quicker. The lower parts of the house are considerably safer. The fire only completes the work of the smoke. It is doubtful if any people are ever burned to death in the auditorium. Prevent the stage fire and a theatre becomes as safe as a hall or church with galleries. It is not enough, however, to pass building acts; full provision must be made for faithful inspection at short intervals with a strict enforcement of severe penalties for every invasion; the best of which penalties would be to promptly close the building to the public.

The theatres already in existence should be remodelled to conform to the requirements for new ones, so far as the nature of their sites will permit. Where sufficient safe exits cannot be had from any part of the auditorium or stage such part should be permanently closed and remain so until means are found to remedy the evil.

The indifference of the public to its own safety is often as phenomenal as its patience under unnecessary and undeserved impositions. When great disasters come it gropes blindly for victims, and the men sacrificed, although they may be the immediate agents of the catastrophe, are often secondary to the real cause, which lies in the neglect of everybody of the interests of all. Adding one funeral to many is no proper way to cure a general defect. The proper way is to fortify the expert architect or builder with wise and well-considered laws first, and then hold him to strict responsibility within the law. But after all, why should the present dangers of theatre-fires be endured? What is there of real pleasure in the sight of tawdry transformation-scenes and the realistic effects of modern burlesque or melodrama that such prices should be paid for the hazardous enjoyment of them? The best play of the last forty years, which achieved a long and profitable run, was produced with a poverty of scenic effects and a dinginess of auditorium surroundings that would disgust a dime-museum manager. Good plays well acted would be found to pay again, if set off only by such simple backing as a skilful painter could produce on "flats and wings" of sheet-iron. The theatrical "Battle of Dorking" cannot be long delayed. The multiplication of wretched buildings controlled by reckless management and patronized by a careless and easy-going public will result, in due

time, in a group of appalling disasters which will cause a revolution in methods of amusement at the expense of the present system and its promoters. J. A. F.

EXETER THEATRE.



AT the inquest on the burning of the theatre at Exeter, England, Mr. Fladgate (for Mr. Phipps) stated that that gentleman was desirous of giving evidence or answering any questions that might be put to him. Mr. Phipps would give evidence entirely on his own responsibility and for the sake of his reputation, and not on behalf of the magistrates, who refused to be represented.

Mr. John Phipps said: I am an architect, of 26 Mecklenburgh Square, London. In the early part of 1885 I was requested by the Exeter Theatre Company to visit Exeter and select a site for a new theatre in the place of the one that was destroyed by fire, being also engaged by the insurance company to settle the risk on the old fire. I prepared those plans and sent them to the borough surveyor on July 11, 1885. After an interview with Mr. Cameron, who called at my office in London, I was given to understand that the Town Council, as the urban sanitary authority, had passed the plans. Later in the year, when the building was about to be erected, I suggested to my clients that it would be more courteous to the Magistrates to ask them to look at the plans before a brick was put on the ground. A private meeting of the Magistrates was arranged for October 28, 1885, at which I met the Magistrates. I was told that it was a purely informal meeting. Remarking that it was much more satisfactory to me to show them what we proposed to do, I produced a set of plans. Mr. Cameron was also present, and had in his hands the plans I sent to the Town Council. Considerable discussion ensued in reference to the exits. It was suggested that I should widen the entrances to the pit and have a new staircase from the stalls and the pit opening into New North Road by the gallery entrance. The question of the gallery was also discussed at great length, and I pointed out that the gallery was one floor, which I proposed to divide by a low partition into two divisions, the front part called upper circle, the back part gallery. To each of these divisions there was a separate exit and entrance, which was in strict accordance with the Lord Chamberlain's regulations in London. I also said the plans carried out all essential points in the Board of Works regulations in London. The Justices say they would be satisfied if the alterations already suggested were carried out. This I promised to do. On July 19, 1886, the building having advanced a great deal by that date, I was in Exeter, and I understood that regulations had been sent to the secretary of the Company by Mr. Pengelly, which the Magistrates proposed to attach to the back of the license, in accordance with the Act of Parliament for the license of theatres. In these proposed rules was one prohibiting smoking in any part of the building, and I pointed out to my clients that the wording of that rule was detrimental to the interests of the theatre. I offered to see Mr. Pengelly upon that and ask him if the Justices would be satisfied with the wording of the rule that no smoking should be allowed in the auditory or corridor. I understood also that he had handed the secretary a copy of the Board of Works regulations and the regulations of the Lord Chamberlain. I handed them back to him with the remark that, in my opinion, the plans carried out these regulations. I had no other communication whatever then with the Justices or with their clerk. The Magistrates inspected the building on October 1, and ordered several alterations, which were duly reported to me on October 8. The Magistrates made what they called their public investigation. They came before the time mentioned to me. Consequently I was only present at the end of the inspection. I met them as they were coming through the upper circle corridor. They said, "Where are the cisterns and tanks required by the Board of Works regulations?" I said they were not required. The Magistrates sent for the rules and regulations at once, and I called their attention to Number 13: "In any case where there are no fire-mains there should be cisterns, etc." I then pointed out where the mains were, viz., one in the vestibule of the dress circle and one on the front side of the stage, and each supplied with fifty feet of hose. The Justices, after a long consultation, ordered me to put forty feet of extra hose at each hydrant. The building was advertised to be opened on October 13, and on the day previously the license was applied for. I was not present on that occasion before the Justices, nor was I present when they inspected the theatre the same day. That, so far as I know, was all the connection I had with the authorities. As to the rules of the Metropolitan Board of Works, they were not obligatory to any one building a theatre in the country. Rule 4, with regard to the proscenium wall, was not complied with. The wall above the roof was nine inches thick, instead of thirteen inches, and the same would apply to the wall below the stage. I have built walls in London, under the regulations, of a similar thickness, and they stand at the present time. With respect to the doors under the stage, the Board did sometimes allow two doors leading into the orchestra. I have argued the point with the Board of Works that to make these doors of iron and leave the great opening of the proscenium void was inconsistent. The decorations of the proscenium were constructed of fire-proof material. When I designed the plans the side passages were simply to be used for access to the boxes, and not more than eight persons. I considered the provision, for the safety of the persons using the stalls, satisfactory. I provided that every tier should have a separate exit. At the present moment in London there were in existence theatres built in exactly the same way, and they are licensed by the Lord Chamberlain year after year. As to an iron curtain, when questioned at the meeting of Magistrates on that subject, I answered that it was not obligatory in London, and to my knowledge there was only one iron curtain in England. I considered it a safe theatre. A second exit was suggested to me by the Magistrates. In the flies the gas battens were protected with wire by the best maker in London, and the nearest contact to the flame was ten inches. I considered the hydrants in the theatre sufficient.

A Juror: Do you consider that with the outlay of a couple of thousand more pounds the place could have been rendered safer?

Witness: No, I do not.

Another Juror: Did you assume that the gallery audience could make their escape over the barrier in the stairs?

Witness: Certainly I did; but I must say I did not reckon for the smoke.

Do you think four hundred persons could get down these stairs in a short time? — I only calculated for three hundred people, but the staircase is sufficiently wide for four hundred.

Did you ever say that the rent of a shop would be lost by having a second exit into Longbrook Street? — I have never said anything of the kind.

Do you consider it necessary to provide additional lights in the passages in case of accident? — That was a matter for the management to see to. The stage adjoined some property which was sold by the Theatre Company. Had the property been retained, there would not have been any exit made behind the stage. I have constructed a great many theatres. The ventilation for the stage was good.

The jury on Wednesday gave a verdict of "accidental death," after a consideration of five hours. The following riders were appended to the verdict:

We consider the Magistrates are much to blame, and deserve censure for not having completed their inspection of the theatre and satisfied themselves that all the suggestions made by them had been carried out, especially the second exit from the gallery, and that they allowed themselves to be misled by the architect in the matter of the exit from the gallery to the second circle. We consider, also, that it was unwise to grant a license for a building in such an unfinished state. We regret the action of the Magistrates in declining as a body to recognize the authority of the Coroner's Court, and their lack of courtesy to the Government Commissioner attending it.

The jury regrets that the Town Council by-laws do not allow of their efficient control over public buildings, especially as regards means of ingress or egress, and that their surveyor was not more fully instructed. We recommend a radical revision of such by-laws without delay.

We deeply deplore that the architect, having been engaged by the direction as a specialist, should have produced a building with so many structural defects in place of where so many of our fellow creatures fell at the second landing outside the pay office. We find that many persons lost their lives owing to the post erected there, and consider this post, the gateway below the pay office just above, with the doors opening outwards, a very bad arrangement. The jury think that the architect failed in his duty in not providing a second exit from the gallery. They do not consider the way over the rails from the gallery to the second circle a legitimate exit in any case, and are surprised that Mr. Phipps, as a business man as well as an expert in theatre designing, should have suggested it in his evidence that the gallery staircase, *per se*, was not a ready exit from the gallery, and that when the presence of the post is considered, which Mr. Phipps admits was there on the opening night, they regard it as doubly dangerous. That Mr. Phipps's explanation of the presence of the hydrant in the "flies" on the plan and not in fact was most unsatisfactory. That the jury does not consider Mr. Phipps is qualified to ignore the rules of the Metropolitan Board of Works as regards the erection of theatres, and they think that had he followed those rules as he alleged they would be, he would have acted wisely; that had the architect raised the roof of the auditorium several feet higher it would have carried up the smoke, and have allowed the gallery audience more time to escape.

We consider that legislation bearing upon the inspection and remodelling of means of exit and the stage-working arrangements of all theatres and the prevention of fires therein, should receive the earliest attention of Parliament.

The jury suggest that some effectual plan of excluding fire and smoke from the stage and from other parts of the building be adopted by the fixing of a water screen or other apparatus.

We consider that the Chief Constable should be empowered to make inspections at all times of all parts of the building without notice to the directors or the managers; that he makes such inspection at least once every month when the theatre is open, and thereupon transmit a report of his inspection to the Town Council, and state whether all fire hydrants, ventilating apparatus, etc., are in perfect order.

We suggest that before a Magistrate's license is granted for any public building, such building shall be thrown open (with all its approaches, entrances, and exits), to the inspection, under police supervision, of all householders in the borough, for a week after its final completion.

THE ILLUSTRATIONS

[*Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.*]

HOUSE OF W. WATTS SHERMAN, ESQ., NEWPORT, R. I. MESSRS. GAMBRILL & RICHARDSON, ARCHITECTS.

[Helio-chrome, issued only with Imperial Edition.]

ROOM NO. 4, SOUTH QUAY, GREAT YARMOUTH, ENGLAND. THREE MEASURED DRAWINGS BY MR. C. J. BROOKE.

[Issued only with the Imperial Edition.]

THE house in which this room is to be found has a great historical interest. It was built in 1595 by one Richard Carter, a wealthy merchant, and one of the leading aristocracy of that period, and friend of Oliver Cromwell, and in a room set apart for the purpose (the subject of our notice), Cromwell and his followers frequently met to transact business, and at one of these meetings it is supposed the death warrant of Charles I was signed, also the warrant for his apprehension. The room is still in a fair state of preservation. The walls are of carved oak, black with age, and the ceiling is entirely of plaster-white ornaments on a yellow ground. These drawings received a third grade and a Queen's prize in the National Competition at London, and the Mayor's prize at Yarmouth.

FIRST PRESBYTERIAN CHURCH, MINNEAPOLIS, MINN. MR. W. H. HAYES, ARCHITECT, MINNEAPOLIS, MINN.

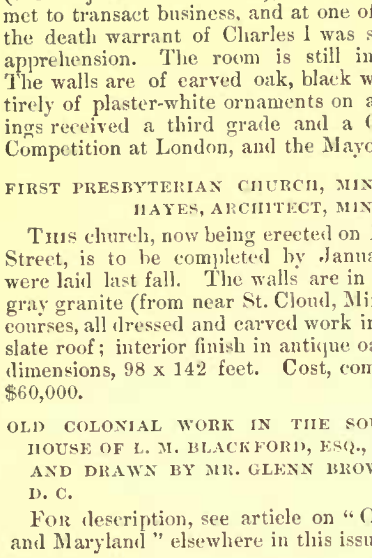
THIS church, now being erected on Portland Avenue at Nineteenth Street, is to be completed by January 1 next. The foundations were laid last fall. The walls are in broken range, rock-face, warm gray granite (from near St. Cloud, Minn.), with jambs, arches, string-courses, all dressed and carved work in Lake Superior red sandstone; slate roof; interior finish in antique oak; heated by steam. Ground dimensions, 98 x 142 feet. Cost, complete, will be from $55,000 to $60,000.

OLD COLONIAL WORK IN THE SOUTH. — DETAILS FROM THE HOUSE OF L. M. BLACKFORD, ESQ., FAIRFAX CO., VA. MEASURED AND DRAWN BY MR. GLENN BROWN, ARCHITECT, WASHINGTON, D. C.

FOR description, see article on "Old Colonial Work in Virginia and Maryland" elsewhere in this issue.

COMPETITIVE DESIGN FOR THE SYNDICATE BUILDING, STATE STREET, BOSTON, MASS. MESSRS. MCKIM, MEAD & WHITE, ARCHITECTS, NEW YORK, N. Y.

THE HYGIENE OF THE THEATRE.[1]



BY "Hygiene of the Theatre" is meant the study of the best structural and decorative arrangements to be adopted in the construction and fittings of theatres, music-halls and kindred establishments, with a view to the comfort and safety not only of the public but also of the players and other people employed, together with a consideration of the physical and psychical conditions of the performance generally. It is somewhat remarkable to find inquiries on so important a branch of the public health thus neglected in a country which is supposed to pride itself on the excellence of its sanitary laws and institutions, for, with the exception of a short series of articles published anonymously in the *Stage* newspaper[2] last summer, the medical aspects of theatre life generally appear to have been overlooked.[3] Our neighbors across the Channel must take the credit of being the pioneers in the direction of theatre hygiene. The first work bearing on the subject, omitting references to a few scattered notices in the reviews and press, we believe to have been published in pamphlet-form in 1864 by Dr. Tripier,[4] of Paris. This gentleman, who is still living, has often been consulted for an opinion not only as to remedying structural defects in certain already-existing French theatres, but also as to the hygienic requirements of proposed ones[5] — an example which it would be well for some of our English managers to bear in mind and imitate.

The ill-ventilated condition of several of our play-houses is notorious; the stifling temperature in the gallery, the lethal oppressiveness in the pit, and general atmospheric disturbing influences in other portions of the building, are often matter of serious consideration to the play-goer when making choice of an evening's entertainment. There are many people with rooted objections to attend an evening performance on a day when there has been a previous afternoon one; a similar principle underlies their rigorous dislike to being present on a Saturday night, when, especially of all days in the week, the atmosphere is unusually vitiated from the previous five nights' continual run, unless stringent preventive measures be taken by the management. This keen appreciation of good and bad air is, of course, more affected by some than by others, but we ourselves have met with cases where people, owing to the imperfect removal of the air from the preceding night, are prevented attending morning performances at all, except at the cost of a headache or other troubles, while they are enabled to sit through an evening's entertainment with impunity.

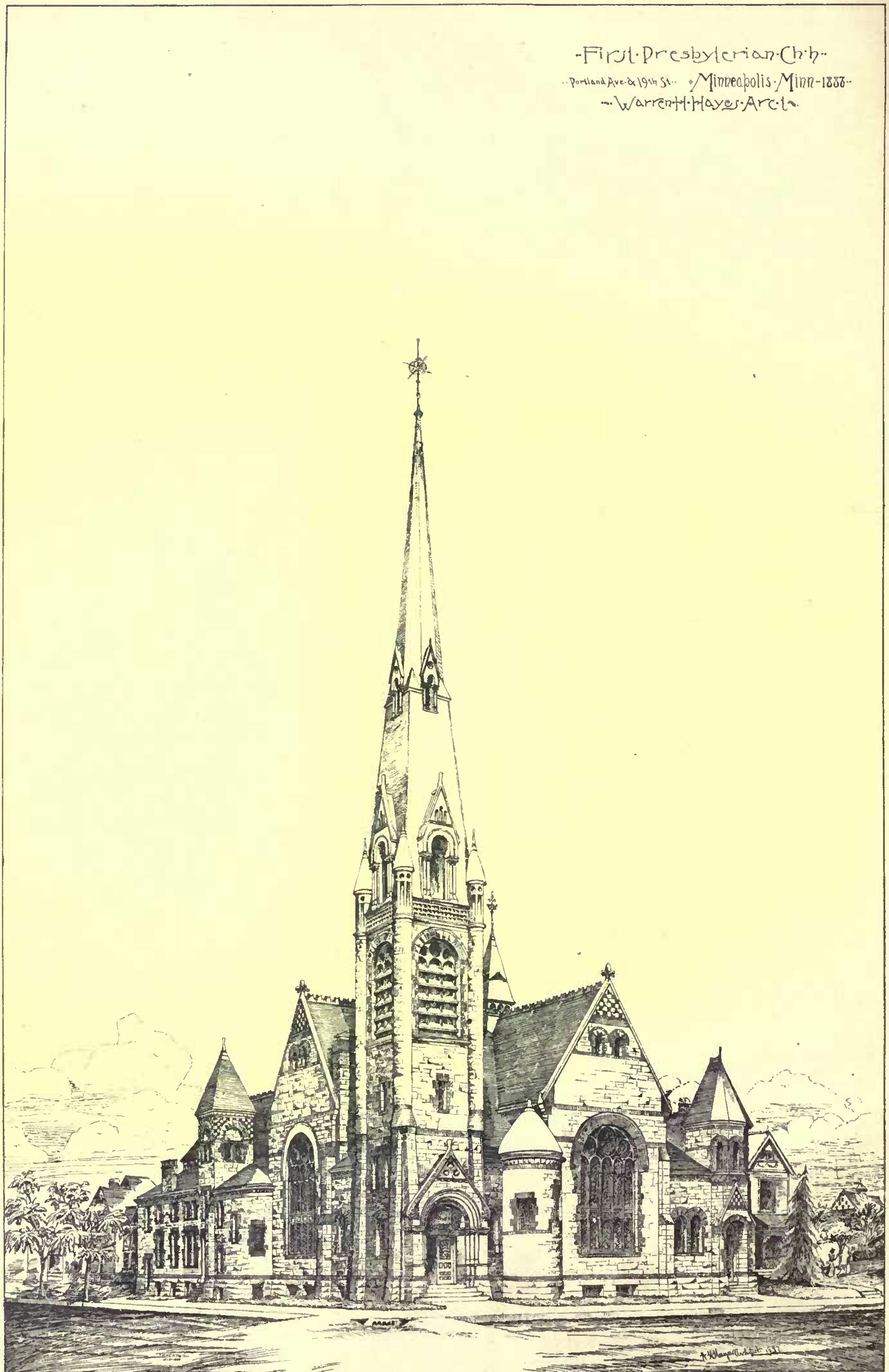
But the fact must not be left out of sight that the performers themselves are often, and perhaps as constantly, laboring under similar and probably worse disadvantages. As the anonymous writer in the *Stage* very tersely expresses it, the actor, to start with, is enveloped in the various odors of oil, turpentine, and other delights of stage-preparations. At the rising of the curtain, owing to draughts created by the intense heat of the footlights and masses of light burning at the wings and borders, he is greeted with the whole air of the auditorium and its "orange-peppermint" accompaniments, and, with the progress of the evening, owing specially to changes in rarefaction of the air, combined with other causes, he is obliged to make use of far greater exertion in making himself heard towards the close of a performance than was necessary at its commencement.

The position of the exits for vitiated air varies a good deal. Sometimes they are placed at the back of the stage, or through the wings; often "the exit is at no higher level than that of the dressing-rooms, which, accordingly, get filled with bad air. The ordinary funnel-shaped ventilators in the dome, worked by a ring of gas-jets, is not sufficient, for the heat of the central burners often overflows the opening and returns to the room."[6]

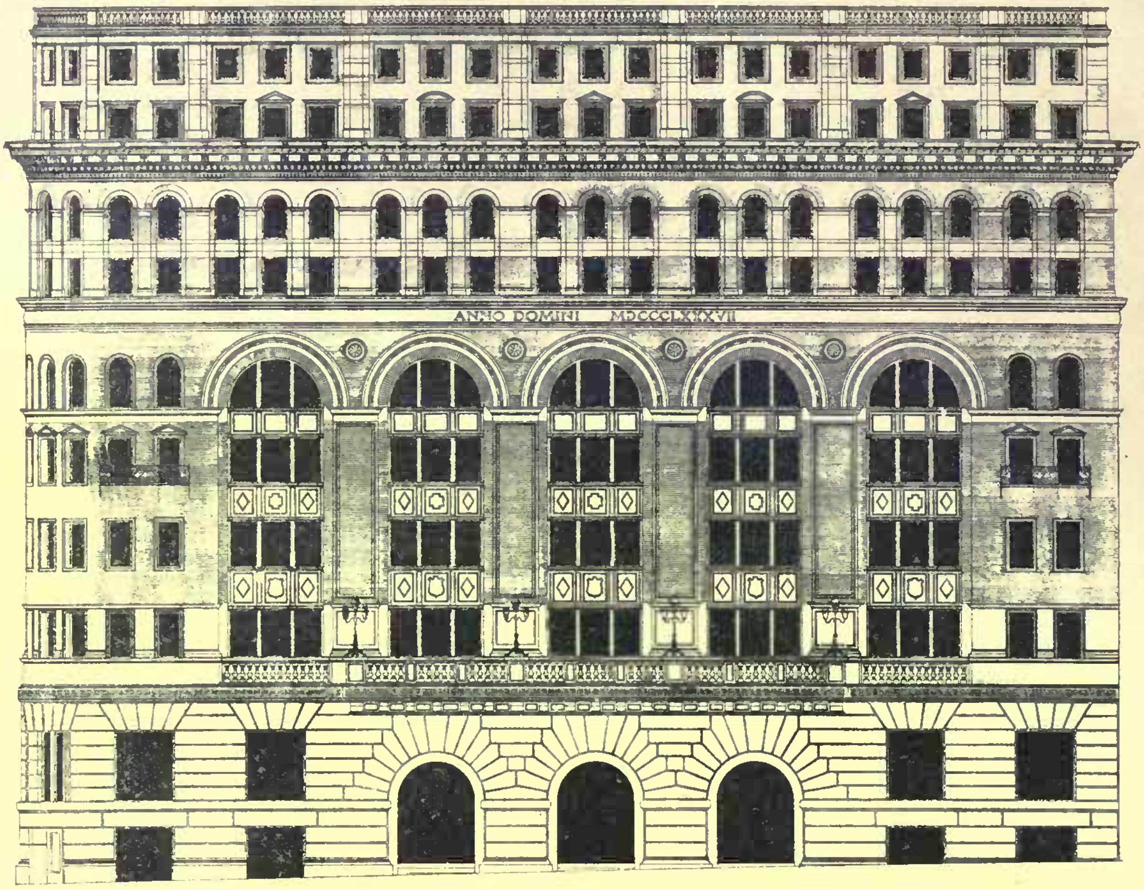
It will easily be understood that the demonstration of existing defects is a matter of far less difficulty than that of their best remedial agency — a difficulty all the more increased when it is remembered that no reliable experiments have ever been instituted for the purpose of discovering in what and in how many directions the vitiated atmosphere is at fault. At first sight the undertaking of such researches appears a comparatively easy matter, but it may be interesting to point out to what a fearful extent they might be carried, provided, of course, that thoroughness of detail and correctness of results were the chief aims required. We should have to determine[7] the relation of the quantity of organic matter and of the number of micro-organisms to the quantity of carbonic acid present, and then make suggestions for a standard of purity, the determination of the carbonic acid alone being never an indication of itself of the condition of the air in a room, that is to say, *not* a measure of its total impurity. The necessity thus arises of taking into account the circumstances affecting the quantity of organic matter in so far as it is influenced by the lighting agent, coal-gas, oil or electricity, the state of cleanliness of the building, the number of people present, a morning *vs.* evening performance, the cubical capacity of the structure, the method of ventilation, and, especially at music-halls, promenade and smoking concerts, how far it is affected by a seated or ambulatory audience and tobacco-smoke. Similarly it would be essential to determine the quantity of micro-organisms, the ratio of the bacteria to the moulds, and to see how far the total number is altered by increased cubic space and cleanliness and age of the building, by day *vs.* night entertainments, tobacco-smoke, the form of ventilation, and by cleanliness of clothes and person — an important factor when making comparison of theatres in low and in better-class districts. Such analyses would be required of the air taken from at least three different portions of the edifice during the course of the entertainment, and even when that were done, would have to be repeated for the object of cancelling error. Furthermore, for all reliable purposes we may say that each analysis would require a minimum quantity of ten gallons of air, and when it is remembered how many obstacles must be overcome, not only in carting forwards and backwards a score or so of carboys, each capable of containing such a volume, but also of keeping them hermetically sealed after exhaustion, and opening them during the progress of the performance without creating a disturbance or dynamite scare among the audience — well, he must, indeed, be a bold man to venture on such experiments.

The remedies for present defects in the way of ventilation are necessarily, therefore, more or less empirical, but it may prove interesting

[1] A paper by Walter E. Roth, B. A., Late Demy of Magdalen Coll., Oxon; Author of "*The Elements of School Hygiene*," published in the *Sanitary Record*.
[2] "Hygiene of the Stage," July to October, 1886.
[3] Since the above was written, a paper, with discussion, has appeared in the *Journal of the Society of Arts*, March 18, 1887, on "Scenic Illusion and Stage Appliances," by Mr. Percy Fitzgerald.
[4] "*Assainissement des Théâtres*," Paris, 1884.
[5] On this subject see a paper by F. O. Kuhn in "Bericht über die Allgemeine Deutsche Ausstellung auf dem Gebiete der Hygiene und Rettungswesen," Breslau, 1885.
[6] *Stage*, August, 1886.
[7] The writer is indebted to Professor Carnelley for this line of procedure of air-analysis. This gentleman made some very interesting investigations on the subject in the Dundee Schools. See "*British Association Reports*," 1886.

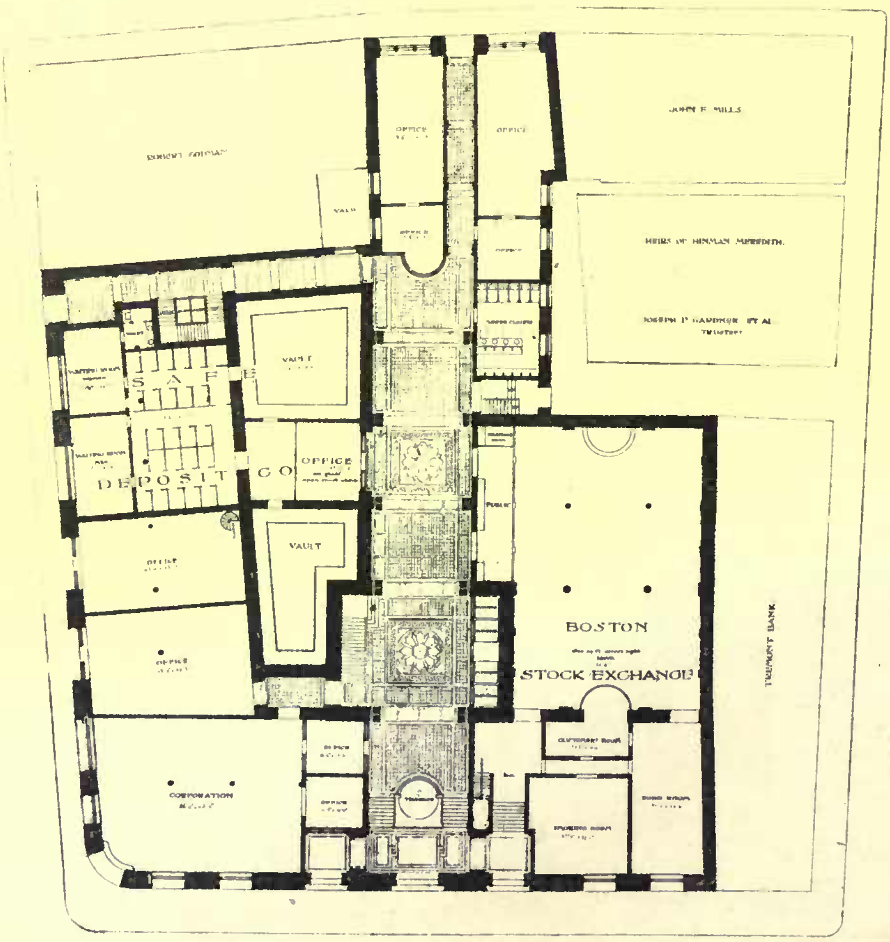


Heliotype Printing Co. Boston.



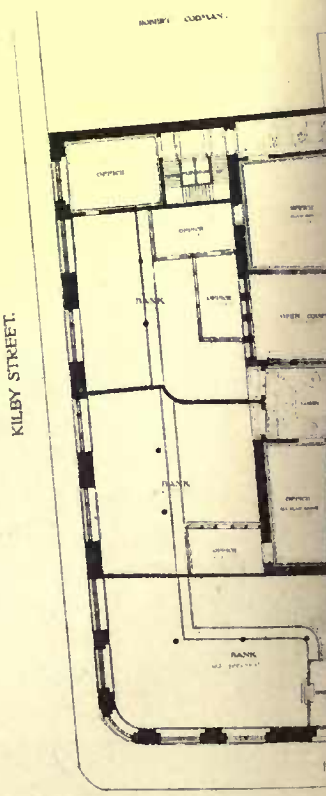
ELEVATION ON STATE STREET.

PROPOSED
NEW EXCHANGE BUILDING.
FOR THE
STATE STREET SYNDICATE
BOSTON.



PLAN OF BASEMENT

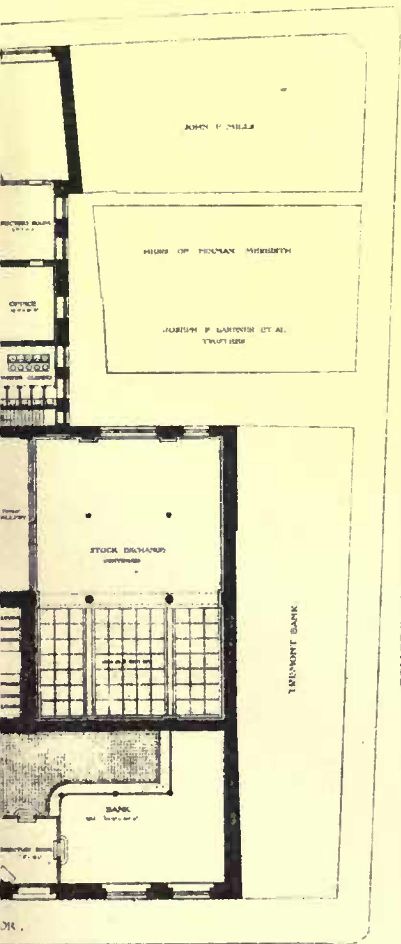
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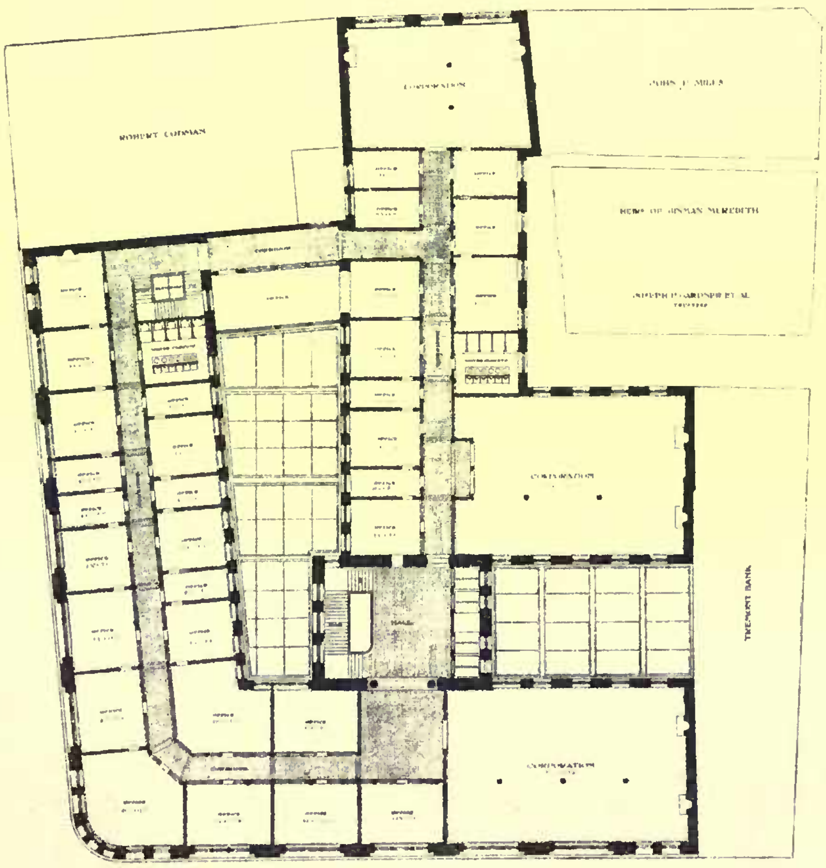


VIEW IN HALL

McKIM MEAD & WHITE.
ARCHITECTS

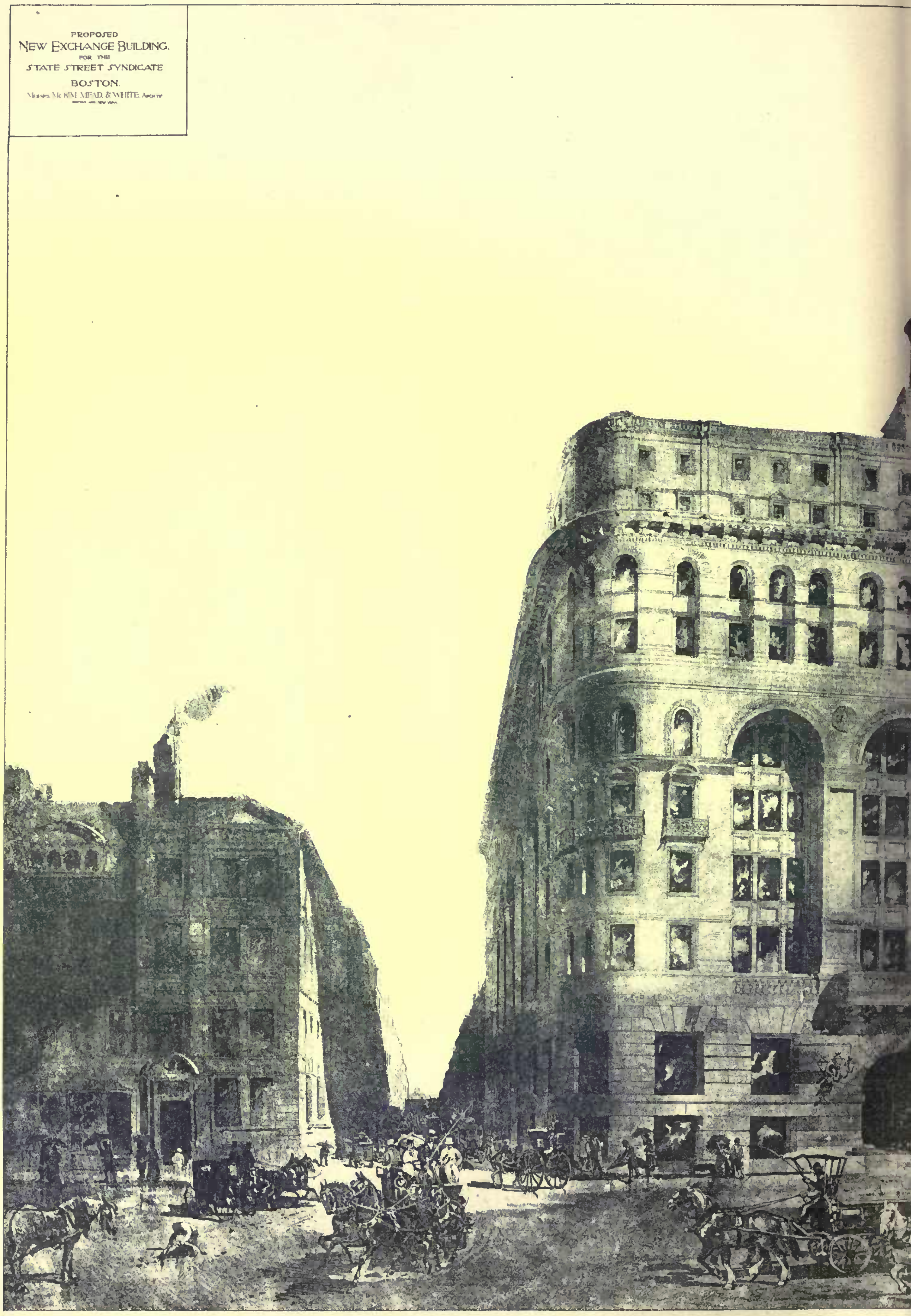


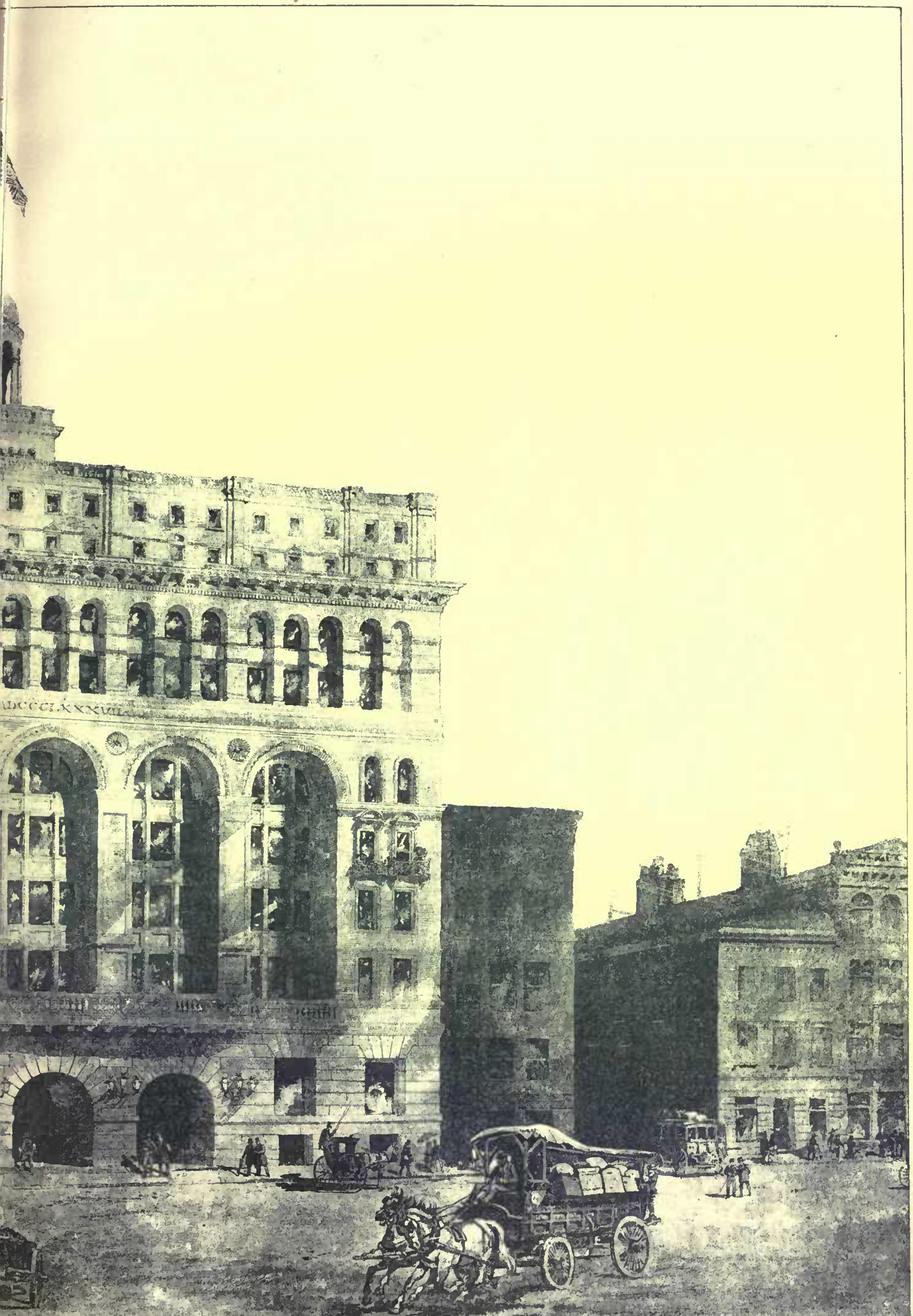
CONGRESS STREET.

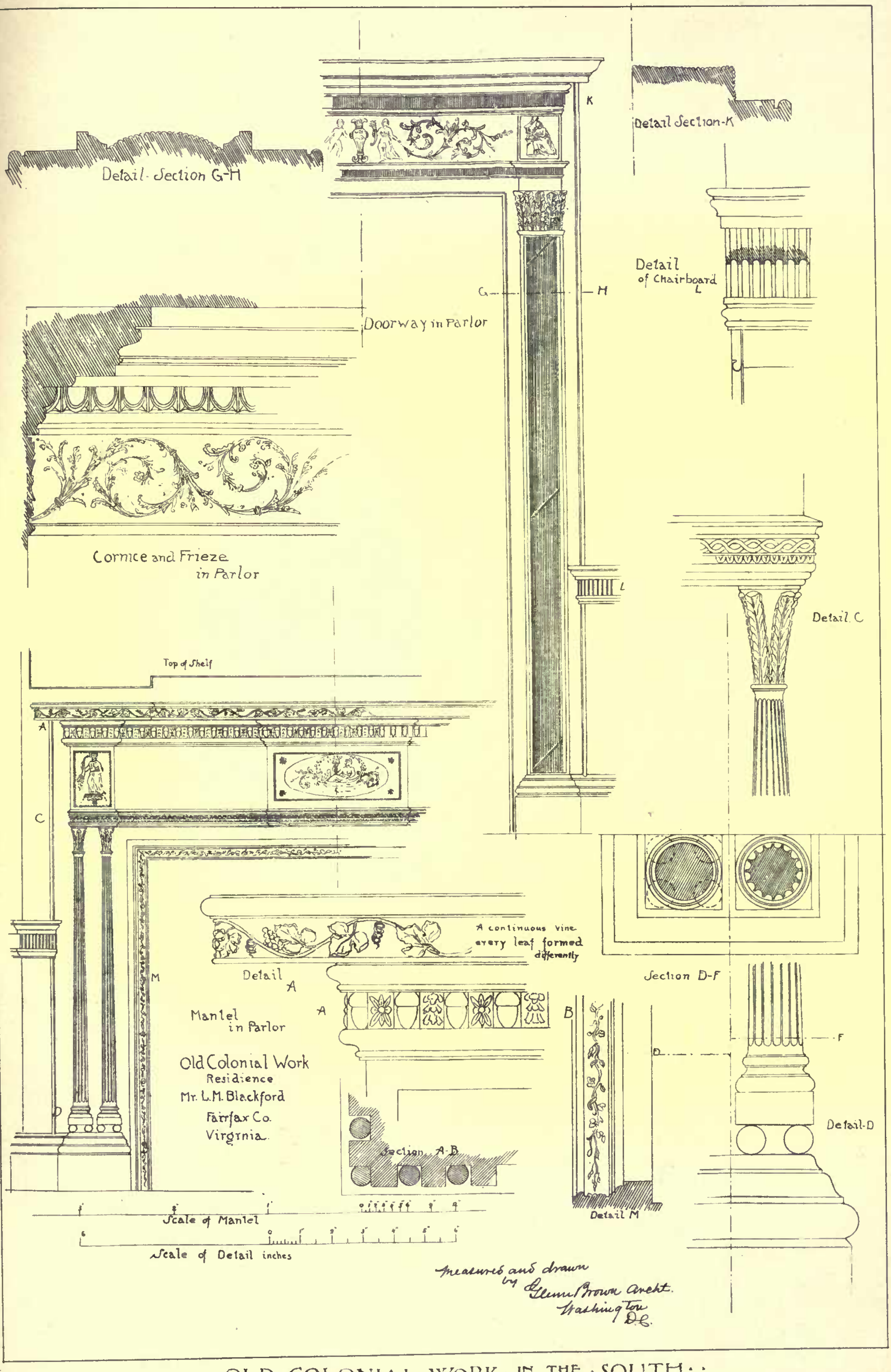


PLAN OF SECOND FLOOR.

Heliotype Printing Co. Boston.


PROPOSED
NEW EXCHANGE BUILDING.
FOR THE
STATE STREET SYNDICATE
BOSTON.
Messrs. McKIM, MEAD, & WHITE, Archts


MDCCCLXXXVII



· · OLD · COLONIAL · WORK · IN · THE · SOUTH · ·

to mention some of the many contrivances which have been suggested and often successfully put into practice. The Board's regulation on the subject (sect. 10) requires that all openings for ventilation be shown on the plans and properly described in the specifications. The openings shall be made in such places and in such manner as shall be approved by the Board — which leaves it an open question! "A well-known manager of considerable experience has proposed that fresh air should be supplied from under the stage where openings through the walls might be made to communicate with the outer air, and the stream might be conducted through refrigerating chambers, either packed with ice or subjected to cold-water sprays. These chambers would communicate with branching conduits, which could be so arranged as to disperse their contents freely throughout all parts of the theatre, not even omitting the stage."[1] By some authorities it is suggested to make the separate ventilation of auditorium and stage imperative; by others, the exits for vitiated air are designed above the stage and in front. A good plan, we believe, of French origin, is to create slow, upward draughts by warming either the circumferential walls themselves, or else the external corridors. On a hot summer's night many are cognizant of the agreeable atmosphere that may be enjoyed at the Canterbury or Pavilion Music Halls owing to the peculiar construction of the roof on the sliding principle; in the latter establishment the absence of gas-lights no doubt tends to make the air even still more pleasant than it might otherwise be.

As to lighting arrangements, there can be no doubt as to the expediency, from a health point of view, of resorting to electricity as an illuminant in our public buildings, but until its initial cost and efficient maintenance can be guaranteed as less costly than it is at present, we can little hope to welcome its introduction except into the West End and more fashionable houses. At present the heated atmosphere and noxious products of combustion militate strongly against the use of gas. Gas footlights are a terrible ordeal to the poor actor; unless well accustomed to it, his eyes are worried with the flickering glare and his throat often parched up, at a distance of a few feet even, by the oppressive heat and vapors arising. It remains to be seen whether the new Welsbach lamp[2] — the light employed being that of ordinary gas raised to a point of incandescence by a newly-patented process — will warrant a claim on the notice of those enterprising managers who, while unable to bear the expense of electricity, might see their way to introducing what is stated to be an equally good illuminant and, what is more, a less costly one.

There is nothing special to be noted in the way of warming apparatus save that, by law, artificial warmth by means of hot water, and that at a low pressure, is the only method permissible in our own theatres. The body of the building soon gets sufficiently warmed with the ingress of the spectators.

Inadequate provision in the way of latrines, etc., is, indeed, remarkable, and, when present, their construction and ventilation are often of so primitive a character that the olfactory organs serve as the best guide to their whereabouts. At a "certain East End theatre, where the latrines are erected *below* the level of the drainage . . . the abominable smells that arise through the boards render even the stage almost as offensive as a dirty stable, and must be most annoying to the occupants of the orchestra."[3] At other places the public wants are often to be found supplied just outside the pit or gallery doors. But disgraceful arrangements such as these are by no means limited to the poorer districts of the metropolitan area, for notably at one of the West End and well-frequented houses the cause of complaint is situated just within the stage doors. The temptations to which any decent girl may possibly be exposed when earning a hard livelihood before the footlights are already quite enough for her to bear without necessarily having her modesty sullied by sights of which, in such cases, she has to be an unwilling spectator. On more than one occasion we have been assured that the unfortunate belief ordinarily maintained by the lower classes in the immorality of the stage is in the main attributable to the undue public prominence given to the latrines at the theatre doors — actors and actresses cannot be gentlefolks!

Actors often have the most abominable rooms to dress in — a small room with one window, if any at all, and a door facing the wing, whence the abnormally-vitiated and heated air from the stage and body of the theatre rushes in with full force each time the door is opened. In some cases the dressing-room is situated high up above the stage, making the atmosphere even fouler than it would be lower down, while in others it is placed underground; the only locality where these rooms are not permissible by law is over the auditorium or in the space under the same. Even the means of washing, etc., are sometimes totally inadequate. Of course it might be argued that the remedy for such defects lies in the hands of the performers themselves, who, either by "striking" or other agencies, could demand superior accommodation, but, unfortunately, there is at present no such institution as an Actors' Mutual Defence or similar association that might enforce better treatment.

It is a very difficult matter to solve the problem of supplying the public with comfortable chairs, seats and benches; want of space is evidently one of the chief drawbacks, for by the regulations of the Metropolitan Board of Works (sect. 2), . . . the area to be assigned to each person must not be less than 1′ 8″ by 1′ 6″ in the gallery, nor less than 2′ 4″ by 1′ 8″ in other parts of the house. Owing to the exceptionally high and steadily-increasing value which building land in London has reached during the last few years, managers of newly-erected theatres are obliged to look after their own interests in securing new patronage by accommodating as large a number of spectators as is permissible in the space assigned, and, if anything, by reducing the prices of admission. On the other hand, managers of existing structures are prevented from supplying their visitors with more commodious fittings on account of the keen competition to which increased prices, consequent on the reduced accommodation, would be certain to give rise. In either direction, then, the management is severely handicapped, and, in order to economize space, and yet to avoid a breach of the law, many devices have been resorted to. With this end in view, and perhaps also to shun too close proximity to the front rows of the audience, the orchestra is often placed under the stage; an objection to this arrangement, however, is that the musicians can now only and solely follow the beat of their conductor, and not at the same time the expression and "tip" of the actor, who, having, therefore, most stringently to follow his lines, is prevented "giving effect," an obvious drawback in operatic singing. For the same purpose of making room, several managers believe in the blocking up of the gangways with chairs, and evidently the state of the law permits of it along the centre and cross aisles; the Board only requires (sect. 5) that . . . there must be a clear passage or gangway of not less than three feet wide reserved round every part appropriated to the audience except that near the proscenium, or place of performance. The most convenient remedy for the suppression of the evil appears to us to lie in the checking of the number of spectators at the entrances. This being known to the management might, by law, be systematically reported to the Board, which, in cases of overcrowding, could take a summary course of procedure.

At present, the customary arrangement is to have the seats side by side in rows parallel with the stage-front, so that the legal space, small enough as it is, assigned to each individual, not only serves the purpose of a seat for the occupant, but also as a kind of passage-way for his neighbors.

If only the management could afford it, what comfort would accrue from the plan we only dare whisper of having all the seats placed in double or treble file vertically to the proscenium, with gangways intervening.

It would be curious to learn the data on which the regulation space was primarily determined, and also to know why an occupant of the pit should be blessed with sixteen more square inches than his impecunious brother in the gallery. The following sketch (Fig. 1) was taken from nature, and represents an individual in the front row of the gallery at a well-known West End theatre, where the short distance between the back of the seat and the boarding in front necessitates the cramped position indicated, the pressure of the crowd laterally not admitting of the sitting posture sideways. Probably the only mementoes of the evening's entertainment that this visitor to the gallery will take home with him will be a pair of stiff arms and legs, a broken back, sore knees, cramped toes, a worse temper, and a smashed-up hat. Given the time and opportunity, we could easily expatiate upon the sorrows of poor Lazarus, but let us away, and see whether Dives in the shape of some fair occupant in a private box is faring any better. To the public gaze she probably appears as the charming reality of some delightful dream, *i. e.*, as much as is seen of her, but, fortunately, we have been favored with a private view, and the initial cut represents the sight with which we were rewarded. Owing to the vertical construction of the box-front, the lady in question is prevented bringing her chair sufficiently forwards and tucking her feet up comfortably, hence, the awkward and changeful contortions of her head, arms, trunk, and extremities. She, also, will probably have the same lively recollection of that night's performance as our humble friend already referred to.


Fig. 1

The omission of the customary fan and opera-glasses in the picture suggests their having, perchance, rolled over the arm-rest on to the head of some unfortunate victim below. We are under the impression that the Savoy is the only metropolitan theatre where precautions are taken in view of such accidents, by providing the fronts of the boxes, etc., with turned-up edges.

In a general way the life of an actor may be spoken of in very favorable terms. There is not too much, but yet quite sufficient study to keep his mind healthily occupied; the amount of exercise, with rehearsals by day and performances by night, is quite ample to keep his physical powers actively engaged, while, what with a moderate amount of excitement, both are maintained in good repair by plenty of change of associations, ideas and dress. Various circumstances have hitherto prevented us from instituting careful or reliable inquiries into any diseases or afflictions peculiar to the profession; among other sources of information there would probably be a fruitful field of search in the books of the various sick and benefit

[1] *Stage*, August 20, 1886.
[2] *Daily News*, February 3, 1887.
[3] *Stage*, August 20, 1886.

societies — notably the Actors' Benevolent, the Royal General Theatrical, the Drury Lane Theatrical, and the Dramatic and Musical Sick Funds, as well as the Music-Hall Sick Fund Provident Society. Mortality statistics are also difficult to get. Judging from the lives of some of our eminent actors and actresses, the practice of their art appears on the whole to have had little or no effect in curtailing the normal of natural existence, though it is possible that, other things equal, the longevity may be ascribed to the constant mental application exercised. With regard to lung and throat affections, colds and catarrhs are more apt to occur in aspirants for honors on the music-hall boards than on the stage, a fact easily explained in that the former are liable to far greater exposure from having to perform at sometimes three, or perhaps four, different music-halls during the course of an evening. As far as our limited experience goes, there are no reported cases of "clergyman's throat." An explanation of this is easy, when we bear in mind that whereas the parson usually harps on more or less the same note, which necessarily sooner or later becomes strained, the actor is continually employing a very varied series. Eyesight among actors is usually strong; the eyes can be long fixed without the slightest blinking. Shortsight is exceptional, but this is only what we should have been led to expect from the very nature of the requirements of the profession. The different phenomena comprised under the term "stage-fright" are far from being thoroughly understood, though possibly they are all explicable by sudden want of confidence brought on by various causes. And, whereas in the olden days, performers had often to be content with a day or two in getting up their parts, it is quite common nowadays, thanks to a plentiful market and long runs, for actors and actresses to have the full advantages of four or five weeks' rehearsal.

A statement having been current in one of the dailies somewhat to the effect of "long runs" being injurious to the mental condition of the performers, information on the subject was last year sought from certain London "stars" by the editor of the *Pall Mall Gazette*, in which the series of replies was afterwards published. Unfortunately, nothing of paramount importance was to be gleaned from the opinions expressed. To put it shortly, long runs are bad for art, but good for actors.

As in all other walks of life, so here in the histrionic, the individual ultimately becomes more or less imbued with the certain ideas and sentiments peculiar to the exercise of his profession. The rôle of self-deception which the actor, in the earnest fulfilment of his duties, has so continually and repeatedly to play, without doubt exercises some deep and certainly recognizable changes in the moral tone and character — changes of which he is probably not so cognizant as are his friends and intimates. Habit soon becomes a second nature. "The actor, though . . . he does not feel all the spectator is apt to attribute to him, tends, when vividly representing to himself a particular shade of feeling, to regard himself as actually feeling in this way. Thus it is said of Garrick that when acting Richard III he felt himself for the moment to be a villain."[1] "The late Mrs. Siddons was mentally Lady Macbeth from the moment when she stepped into her carriage at her own door till the curtain fell at her last scene, and she had resumed her private dress. She did not approve of any person intruding on her feelings and attention during the progress of the play, even between the acts. . . . One effect of the constant practice of players in calling up and exhibiting the natural language of the feelings is to render some faculties habitually prone to action in themselves in private life The great tragedian, who may be said to wield a magician's power over the propensities and sentiments of his audience by means of natural language, suffers in his own mind many tragic feelings from the trained activity of his organs. Many are irritable in consequence of the trained action of combativeness, destructiveness, and self-esteem — the stock elements of heroic and tragic characters. They are often melancholy and desponding from the trained action of cautiousness, which furnishes the perturbed and distracted countenance, the horror-stricken look, the shriek of despair, and sometimes the madness that petrify us when represented on the stage. The higher sentiments and intellect of the actor may govern his deportment in public, so that his general acquaintances may not observe these effects, but the close spectator recognizes them, and the actor confesses and laments them to his bosom friend."[2] Such is the opinion of George Combe, one of the most enlightened and enthusiastic educationists this country has ever produced. He had abundant opportunity for informing himself on these matters, placed as he was on an intimate footing with several eminent and philosophical actors.

The only law of which we are aware bearing directly on the employment of children in theatres is in connection with dangerous performances — 42 & 43 Vict., c. 34 — wherein it is made a punishable offence for any person, parent, or guardian, who shall cause any child under the age of fourteen years to take part in any public exhibition or performance whereby, in the opinion of a court of summary jurisdiction, the life or limbs of such child shall be endangered.

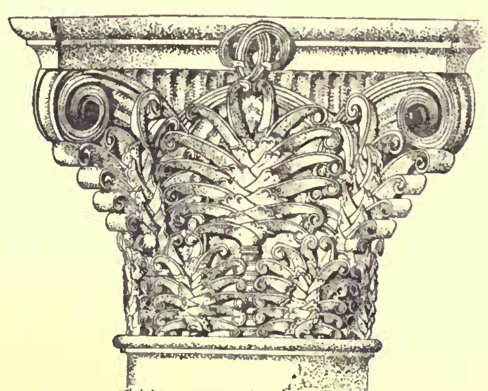
Time, unfortunately, does not now permit our entering upon a discussion of yet another topic which is closely connected with the study of theatre hygiene, and that is the question of the prevention of accidents in connection with stage apparatus and scenic appliances. We trust to be permitted to do so on some future occasion.

[1] J. Sully, *Illusions* (Int. Sc. Series), London, 1882.

[2] George Combe. "*Education: its Principles and Practice.*" Edited by Wm. Jolly. London, 1879.

BUILDING MATERIALS.[1] — VIII.

PAINTING.



Application of Aloe Forms
H. H. Statham in The Builder.

THE method ordinarily adopted for preserving wood is that of painting, and, in order to secure the attainment of this object, it is necessary that the material used for the solid portion or pigment should consist of some substance which can be obtained in a very fine state of division, and which is but little liable to change by long exposure to the weather. Various metallic oxides, such as the oxides of lead and zinc and the higher oxides of iron, fulfil these requirements, and we consequently find that these substances enter largely into the composition of paints. By far the most important of all the substances employed as pigments is that which is known by the name of whitelead, which varies in its character according to the process adopted in its manufacture. In spite of the very numerous alleged improvements that have been announced within the last thirty years as having been made in the manufacture of whitelead, the largest portion of the best whitelead is still manufactured by the old "Dutch" process, as it is termed, from its having been introduced into this country from Holland. This process depends upon the corrosion of metallic lead; it is well known that when lead is exposed to moist air, the surface of the lead is corroded; that is, it is converted into a white substance which consists of carbonate and oxide of lead. The purest metallic lead is most susceptible of this change, and it is partly on this account, and partly because the whitelead produced from the purest lead is of a better color, that manufacturers of whitelead are always anxious to obtain the best brands of metallic lead in the market. Nearly all lead contains traces of copper and silver, and very small quantities of these impurities affect the quality of the whitelead so much so that, when silver is present, even to so slight an extent as one-and-a-half-ounces in a ton of lead, it imparts a distinct pink color to the whitelead. In carrying out the manufacture by the Dutch process, the lead is first cast into gratings or crates by pouring the melted lead into an iron frame with longitudinal and transverse grooves into which the lead runs. This is done by machinery, the iron moulds are fixed on to an endless chain, and are being continually filled by a small stream of melted lead flowing from an orifice which can be opened or closed at pleasure, so as to regulate the flow of the metal. As the chain moves round, the crates of lead, when they have become solid, are thrown out, and are taken away to be placed in the corroding pots. The object in casting the lead in this form is to promote a freer circulation for the corroding vapors, and a larger amount of surface of metal to be acted upon than would be the case if the lead were cast in solid thick pieces. The corrosion is effected by exposure to the combined action of the vapor of acetic acid, carbonic acid and moisture. The pots in which the lead is placed are made of earthenware, and have a shoulder in the interior about one-third of the height of the pot, upon which the coiled crate of lead rests. The pots are stacked in large beds of spent tan, which is spread evenly over the floor to the depth of two feet or three feet, upon which the pots are arranged in rows. Into each of the pots is put about one pint of acetic acid of about the strength of ordinary vinegar, which fills the pot up to the shoulder upon which the crate of lead rests. Tan is then placed around the pots to a level with the top, and a floor of loose boards is laid across the whole, this flooring is again covered with tan to the depth of twelve inches, a second series of pots, tan and boards follow, which are succeeded by others, the stack being completed by a layer of tan from twenty-four inches to thirty inches in thickness. These stacks are of very large dimensions, often containing as many as from 6,000 to 10,000 pots, turning out from thirty tons to forty tons of whitelead. Ventilating shafts are left in various parts of the stack for promoting the circulation of the corroding vapors through the several rows of pots, and for the escape of moisture. In the course of six or seven days after the completion of the stack, the tan begins to ferment and become hot, which promotes the rapid corrosion of the lead. The process is completed in about twelve weeks, and the stack is then taken to pieces. The temperature is regulated, as far as practicable, by covering or uncovering the ventilating shafts, but it is difficult to secure a uniform temperature throughout the whole of the stack. It will sometimes rise in the centre to 180 degrees or 190 degrees, which causes the acetic acid to evaporate too rapidly without a corresponding increase in the corrosion being effected, whilst at the exterior portions of the stack the temperature is sometimes not high enough, which is also detrimental

[1] A lecture by W. Y. Dent, F.C.S., F.I.C., read before the Society of Arts, and published in the *Journal* of the Society. Continued from page 186, No. 616.

to the quality of the whitelead produced; the best results being obtained when the temperature ranges from 150 degrees to 160 degrees Fahr. It will be seen that the lead in this process is placed under the most favorable conditions for corrosion, being exposed to the action of acid fumes assisted by heat and moisture. On breaking up the stack and removing the upper layer of tan, as well as the boards which covered the pots, the lead is found to have become thickly incrusted with whitelead, only a thin core of metallic lead remaining. If the process has been properly carried out, no acetic acid is left, it having been dissipated by the heat generated during the fermentation of the tan. The separation of the whitelead from the metallic lead, or blue lead, as it is called, which remains, is effected by placing the corroded lead in a covered hopper, where it meets with a stream of water, and falls into a trough in which it is knocked about with wooden rakes. The whitelead, which is easily detached from the lead core which has not been acted upon, is then conveyed to a series of grindstones, by which it is reduced to a very fine state of division, and is carried off suspended in water to tanks, in which it is allowed to deposit. The clean water is syphoned off, and the paste of whitelead is placed in bags and subjected to hydraulic pressure (by which the greater part of the water is squeezed out), dried and ground.

The grinding is conducted in a mill so enclosed as to prevent the escape of dust. The reaction which takes place in the production of whitelead by this process, consists in the formation of basic acetate, which is subsequently decomposed by the carbonic acid generated by the fermented tan, the final result being (when the process has been carried out in the most perfect manner) the production of a basic carbonate consisting of two equivalents of carbonate of lead and one of hydrated oxide. The process is a slow one, involving a great amount of labor; moreover, the arrangements for accomplishing a very simple operation appear clumsy and unscientific: many attempts have consequently been made at different times to supersede it by others of a more rapid and economical character. These attempts, however, although they appeared to be full of promise, have not hitherto been attended with that success that had been anticipated by their originators. It was very naturally supposed that a similar result would be produced by exposing sheets of lead in a closed chamber to the joint action of air, carbonic acid, vapor of water and acetic acid, and various attempts have been made on this basis. The method proposed by the celebrated French chemist, Thénard, consisted in passing carbonic acid through a solution of the basic acetate of lead, and whitelead thus made was for some time sold under the name of Clichy white. Numerous patents have since been taken out for the manufacture of whitelead upon the same principle, but differing in detail. Martin's process consisted in exposing metallic lead in the condition of thin scales (obtained by causing the melted lead to fall upon a revolving copper cylinder kept cool by a current of water) upon a series of racks placed over each other, through which a solution of acetate of lead trickled. The basic acetate thus formed being subsequently decomposed by carbonic acid, the carbonate of lead thus obtained was then mixed with lead oxide prepared by exposing granulated lead in a barrel perforated so as to admit air, and caused to revolve in a trough containing a little water, which washed off the oxide as it was formed. It was found, however, that the product obtained by the precipitation of a salt of lead from solution, even when so manufactured as to possess precisely the same composition as that made by the Dutch process, is more or less crystalline in its character, and does not possess that density upon which the excellency of the whitelead produced by corrosion depends, which is known in the trade by the term "body." The chief objection to the Dutch process is the fact that it cannot be carried out without injury to the health of those engaged in the manufacture, owing to the absorption of lead into the system, partly from the floating particles in the air, and partly through the pores of the skin from handling the whitelead during the several processes it undergoes. The workpeople are consequently liable to attacks of painter's colic, a disease which produces pains in the limbs, a characteristic blue discoloration of the gums, and sometimes partial paralysis. The evils arising from this cause have, however, in all well-regulated works, been greatly diminished, by taking care that, as far as possible, the various operations of scaling, etc., should be carried on in water, by providing respirators for those exposed to the dusty particles, and gloves for those who have to handle the whitelead, and by enforcing the strictest regulations as to cleanliness. The assertion is often made that persons may be affected with lead-poisoning by the vapors arising from a newly-painted wall, but such assertions are not supported by any sufficient evidence. Experiments that have been carefully made show that no lead in any form or shape either evaporates or is carried off mechanically during the drying of the paint. The fact is, that the vapors arising from the oil and turpentine affect some people to such an extent as to make them seriously ill, and the effects produced by fresh paint would be the same whether the pigment employed consisted of whitelead or zinc oxide. Whitelead, as ordinarily used, is mixed to a large extent with sulphate of baryta, a substance which, on account of its high specific gravity, is in much request as an adulterant.

Amongst the most recent substitutes for whitelead as made by the Dutch process, is the so-called "non-poisonous whitelead" of Messrs. Freeman, which is prepared by grinding under considerable pressure a precipitated sulphate of lead with twenty-five per cent of zinc oxide, whereby the density of the mixture is greatly increased. The preparation possesses the advantage of a very simple and unobjectionable method of manufacture, and of keeping its color better than ordinary whitelead when employed in situations in which it is exposed to air containing sulphur compounds, such as in railway tunnels. It is equal to the ordinary whitelead in point of color, and is reported to be so as regards "body" and durability, but this last point can only be decided after the lapse of sufficient time.

For situations in which paint is likely to be subjected to the influence of gases containing sulphur, zinc is decidedly to be preferred to lead as the basis of the pigment to be employed, inasmuch as zinc sulphide, instead of being black like lead sulphide, is of a light color.

Zinc white is an oxide of zinc prepared by burning metallic zinc in a retort or furnace in a current of air, the zinc oxide passing over a bridge into a chamber, in which it is collected. It is then placed in canvas bags, and pressed into a hard mass with the object of increasing its density. It may also be prepared by precipitation from solution by means of lime, drying and calcining at a red heat. By whatever method it may be prepared, it will not compete with whitelead as regards density, neither will it stand the same amount of exposure to the weather.

A patent white sulphide of zinc paint is manufactured at Liverpool by the Sanitary Paint Company, which consists of a mixture of sulphide of zinc and sulphate of baryta, produced by adding a solution of sulphide of barium to a boiling hot solution of sulphate of zinc. The precipitate produced is pressed, dried and ignited in a furnace to drive off excess of sulphur. It is then levigated with water to wash out soluble salts, and the pigment is completed by again pressing, drying and grinding. This paint, when not properly manufactured, has sometimes been found to become discolored under the influence of strong sunlight, the dark tinge which it assumes passing off again after a few hours.

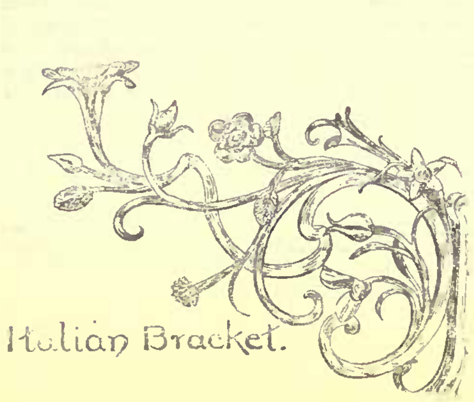
For coating ironwork the black and red oxides of iron have been extensively employed for many years; one of the first paints of this description was introduced about thirty years ago under the name of Torbay paint, from its having been prepared from a brown iron ore found at Torbay, in Devonshire, to which various tints from a light brown to a very dark red can be given by altering the conditions under which it is roasted. The black oxide of iron, which is obtained as a by-product in the manufacture of aniline dyes, is also employed in the preparation of a paint for ironwork. These last-named metallic oxides have not, however, the power of combining chemically with the linseed or other oils used for grinding with the pigment to the same extent as is the case with oxide of lead, which, by combining with the fatty acids of linseed oil, readily produces a soap such as that known under the name of lead plaster.

There is another pigment of some importance that is now manufactured on a considerable scale at the works of the Bristol Sublimed Lead Company, obtained from the condensation of the fumes given off during the process of lead smelting, the escape of which into the atmosphere is known to produce such deleterious results in the neighborhood of lead works. The fumes consist mainly of sulphate and oxide of lead in the condition of a very fine, impalpable powder, which cannot readily be made to subside, the various attempts that have been made for the achievement of this object having been the subject of numerous patents. It is, however, now successfully accomplished by means of flannel bags, through which all the gases and volatilized products from the lead furnaces are forced, the solid particles being retained by the flannel. This powder is collected, and when re-sublimed yields a white pigment which varies in its composition according to the nature of the lead ores employed, but usually consists of about seventy per cent of sulphate of lead, twenty-three per cent of oxide of lead, with a little oxide of zinc. In point of color it cannot compete with ordinary whitelead, but it forms a good basis for lead-colored paints, of which vast quantities are required.

I stated, at the commencement of these lectures, that it was not my intention to enter more fully in the nature of the great variety of substances used for painting than was necessary to give a short description of the pigments usually employed as a basis for the commoner kinds of paints, most generally used for the preservation of wood and iron. All that I have endeavored to accomplish has been to afford some information as to the general principles upon which the technical value of the different building materials passed under review depends, without going more fully into details than is necessary for explaining the matter in hand, and occupying more time than a course of lectures on so wide a subject permits.

PROPOSED GLASS MONUMENT TO GENERAL GRANT. — Among the curiosities which have been received by Mr. Greener at the headquarters of the Association, the most astonishing is a design proposing the construction of three enormous glass shades, similar to the covers placed over clocks or wax flowers, one within the other, the inside and smallest one to be at least 100 feet high and 50 feet in diameter. The designer suggests that the outer shell shall be of red glass, the second one of white glass, and the third of blue glass, and he has sent a colored drawing showing the effect. In the centre of this affair is pictured a statue of General Grant, and on top of all is a silver angel engaged in letting down a crown of laurels from the roof by a rope; in the picture the crown has descended to about five feet above General Grant's head. Upon the pedestal of the statue are the words, "Let us have peace," in gigantic letters. The designer of this monument offers to help along the cost in case it should be accepted by the committee. — *New York Evening Post.*

THE CUBING OF PUBLIC BUILDINGS.

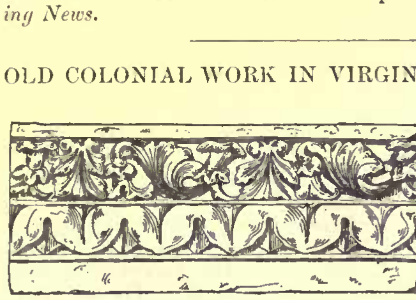


THE plan of obtaining approximate estimates by the method of cubing has now attained to something like a system. At first it was a very tentative and by no means reliable method of estimating buildings. Surveyors and architects of the past generation used to carry in their pocket-books a few of these golden rules of calculating, little imagining that in later times the rough-and-ready cube unit would become a general mode of arriving at approximate estimates, and be introduced into text-books and figure in Government reports of Select Committees. The experiences of a generation or two have enabled the profession to arrive at tolerably accurate rates of cubing for different classes of building, though it ought not to be overlooked that a particular locality may very materially impair the correctness of this mode of estimation. The rates must be taken as general guides in forming an estimate of cost, and in all cases the experience of the architect can alone give value to the system. Then the cube rate cannot be relied upon for work of exceptional elaboration. The cubes generally published are intended to apply chiefly to buildings of a plain character in their several classes, and it would be of value if this circumstance were taken into account in fixing upon the rate. Precision can, however, only be attained by a generalization from extensive experiences, and the evidence which appears in the report of the Select Committee on the Admiralty and War Office sites affords some very useful information from an official source. We may here allude to the instructive evidence given by Mr. John Taylor, the Surveyor of Public Buildings in Her Majesty's Office of Works. In his examination on the estimate for the new blocks of buildings behind the present Admiralty, that gentleman is reported to have said that the cost of a plain brick building would be at the rate of a shilling per cubic fo t. Now this may be taken as a fair rate for a large public building on an open site such as that alluded to. In this plan a large quadrangular court is shown with a screen or colonnade, which we recently described in referring to Messrs. Leeming's able alternative design, prepared at the suggestion of the committee. This court is not included in the superficial area taken of building, though it would have to be drained and paved, and the colonnade would also be a rather expensive item. The actual building area covered in this estimate is 45,-250 superficial feet, while the open court is 195 feet by 155 feet. We leave our readers to make the average rate per cubic foot under these circumstances; the actual building or covered space would, of course, work out something less per foot than a shilling. We simply refer to the figures given. Messrs. Leeming's design was also taken at the same rate, with certain additions for portions that could not be cubed conveniently, such as the ornamental portions, which are lumped. Mr. Taylor stated that, taking the work all round, including the extras, the rate was a shilling or thereabouts. Then comparing the rates of a five-story and a four-story building, the additional story somewhat reduces the cost per cubic foot, so that an ornamental exterior like that of Messrs. Leeming's first design would not be necessarily more expensive per foot than a plain building one story less in height, as was elicited by Mr. Shaw-Lefevre. A great deal of valuable evidence was given as to the matter. Further on in the report we find that 1*s.* 2*d.* is taken as the cost per foot cube for a plain building, but including all arrangements for ventilation, electric lighting and other provisions. We may quote a portion of the question of Mr. Isaacs and reply thereto, as relating to this question of cubing: "Having regard to the character of Messrs. Leeming's building, and the fact that the whole of the façade is to be in stone as against the façade being in brick, does it strike you that the figures in one case bear no comparison with the figures on the other — the 1*s.* 2*d.* against 1*s.*? But I take it that if everything in the nature of open spaces and courts were taken in this design as they have been in plan A, this would come to more than 1*s.* per cubic foot on the actual measurement of the building." Again, Mr. Taylor, replying to another question, observes the first design is a complete structure; the other one, to which very considerable additions are proposed, and where alterations and new buildings are combined, the cost per foot cube would be higher than in the case of building on a site entirely cleared, where the contractor could proceed from the foundation upwards without hindrance. With respect to buildings erected in the Northumberland Avenue, Mr. Isaacs stated that the buildings there have cost as much as from 1*s.* 4*d.* to 1*s.* 6*d.* per foot cube. But there is no comparison between a large block of offices and an elaborately fitted-up hotel. The one is comparatively simple to the other, the decoration to the hotels in the avenue would alone increase the cost per foot. The evidence upon the relation of size or dimensions to cubing rates is of interest. It is certainly a difficult point. Mr. Taylor, in his evidence remarks: "I think the probabilities are that the cubing of a building one hundred feet high would be higher than that of a building fifty feet high. It altogether must depend upon whether the larger building and the higher building has rooms of nearly the same size as the smaller building. No doubt the higher building would require thicker walls; but immediately you get away from comparatively small rooms into very large cubic spaces, then the difference in price is not great." In a fewer words we may say that the cost per foot cube of a building depends mainly upon the divisional internal walls and floors; the more numerous the rooms into which the space is divided the greater the cost. Height is certainly a factor of cost, as a high building requires thicker walls; scaffolding and labor become expensive. But if we take two buildings, one twice the superficial area of the other, but of the same height, the difference per foot would entirely depend on the interior divisions and elaboration of plan. But to say that the cubing of a bigger and higher building is *pro rata* higher than for a smaller and lower one is a proposition that does not always hold. It is so only when the rooms are about the same dimensions in both cases. It would, for instance, be absurd to cube a large public hall with the usual rooms at a higher ratio than a small villa residence because it was larger or higher. In plain English, the greater the internal space and vacuities the less charge must be placed on the cube foot.

With regard to ornamental façades of wrought stone, a considerable addition per foot must be made upon the cost of a plain brick front. To cube both at the same figure would be wrong. The evidence in the report, for instance, goes to show that a considerable saving in cost would be effected in the carrying out of the first design for the Admiralty if the towers were cut off and the engaged and separate columns of the façades were dispensed with, though at a material sacrifice of architectural character and dignity. A plain gauged brick front with stone dressings like that of the old building is estimated to cost about 2*s.* 6*d.* per foot superficial, though the difference between such a facing and the stone front would make a difference per foot cube of only 1*d.* The Home and Foreign Offices cost, it is stated, 1*s.* and one-twelfth of a penny per foot cube, or practically a shilling a foot. Other rates are given that are of value. The General Post Office new building cost 8½*d.* per foot, the Bow Street Police Court 11*d.*, the Marylebone Police Court 9*d.*, all by Mr. Taylor; St. Thomas's Hospital cost 9*d.*; the Royal Exchange is said to have cost 11*d.* The Houses of Parliament cost as much as 2*s.* 6*d.* per foot cube, the British Museum 1*s.* 6*d.*, and the recent additions under Mr. Taylor 10*d.*; the 8*d.* in addition to the original cost of the latter is made up for by the expensive colonnade. Those who know these public buildings will see how materially the cubic space tends to reduce the unit of cost per foot cube.

In speaking of estimating by the cubing system, it must not be understood that we really think it prudent to calculate the cost of buildings in this way, but only for the sake of comparison, and as a very useful and often safely-approximate guide. Government architects and surveyors have generally adopted the system, and in the departments of the public service there are excellent opportunities for making comparisons and tabulating results. Sir William Harcourt in his questioning was too sceptical to believe that such a system could be depended on, and asked whether any builder in the world would take a contract upon an estimate founded upo.ı cubing. We may answer that half the estimates now made by architects and surveyors in their private and public capacities are made by cubing, and that contractors are to be found who would willingly take the risk of carrying out work in that manner. The two most perilous rocks upon which the cuber comes to grief are those of taking a figure without the verification of experience, and not making any allowance for internal elaboration of plan and decoration. — *Building News.*

OLD COLONIAL WORK IN VIRGINIA AND MARYLAND.



A ROMAN FRAGMENT.
— the Museum at Dijon. —

AMONG the houses which I intend to illustrate, a number will be found to date back to the time when we were a Colony of Great Britain, while others have been erected since our independence.

The term Old Colonial is applied to a certain style of work, a free, and in many instances a refined, treatment of Classical details rather than to any fixed period. This work was, without doubt, influenced by English publications during the eighteenth century, by those of James Gibbs (1728) and others. In an old warehouse which has been recently torn down in Alexandria, Va., four old books were found and presented to me, filled with plates of doors, cornices, mantels, etc., one by Langley, 1739, another by Wm. Pain, 1794; of the others the titles were lost. These English works show clearly where the carpenters and builders of the day received their inspiration. The date of the erection of Old Colonial buildings ranges from early

in the eighteenth to early in the nineteenth century, and from my examination of books and actual examples I should say that very little so-called Colonial work was done later than 1815. Such houses are rapidly passing away, being torn down to make place for improvements, destroyed by vandalism, decay and fire. Houses of this character are found in Virginia, on the Chesapeake Bay and its tributaries, the Potomac, York and James rivers, and the country lying between them. In Maryland, likewise, the wealthy and fashionable of early times built near or on the same bay and its inlets.

Examples, as I propose to give them, are not arranged in chronological order, but are illustrated simply as I have found it most convenient to make the necessary sketches, measurements, researches or inquiries.

The house, of which certain details are published in this issue, was erected by a Mr. Cathcart some time between 1800 and 1810, if not before. The only facts obtainable are from the oldest residents, who remember it from their earliest childhood, one or two of them being about eighty years of age. After passing through several hands, it was bought by the Episcopal Theological Seminary in 1835. Although there is nothing of historical interest attached to it, the architectural features are peculiarly refined in effect and very elaborate in detail. All the doors and windows are trimmed in the same manner as the door illustrated by the plate. Every figure in low relief is different, and in this one room there are as many as thirty of them, each, evidently, intended to have a pleasing suggestion, as they represent Abundance, Sowing, Reaping, Pleasure, Religion, etc. The enriched mouldings have each member separately modelled, and this is the same with the friezes around the room and over the doors and windows, each leaf and tendril being different, as if the plastic material of which they are made were modelled in place. The building is now the residence of Mr. L. M. Blackford, principal of the Episcopal High School, and is situated about twelve miles from Washington and three from the Potomac River. GLENN BROWN.

A GROUP OF THEATRE FIRES.



A Roman Fragment. — the Museum at Dijon.

MEMORANDA of their leading features compiled from various sources.

BROOKLYN THEATRE, BROOKLYN, N. Y. — BURNED DECEMBER 5, 1876.

Location. Open streets or passageways on three sides. Plan and arrangement comparatively good for the time and neighborhood. Only one gallery staircase. Construction ordinary — not in any respect fire-resisting, but like the majority of theatres then in use, and very many still in use. Hose and hydrants deficient, and no attempt made to use any. Stage crowded with overstock of scenery from another theatre. Entire lack of discipline in employés. Delay in fire alarm. "Special exit" door for gallery locked. Gas extinguished in exits. The fire caused from a border catching from gas border lights during a performance. Number of lives lost, 300; all in gallery.

OPERA HOUSE AT NICE, ITALY. — BURNED MARCH 23, 1881.

Location in an open square. Plan and arrangement fair. Regular upper gallery staircase single and defectively arranged. Construction substantial and in part fire-resisting. The entrance and foyer sections remained almost intact after the fire. Delay in fire alarm. Special exit door from upper gallery to fire-proof terrace locked. Gas leaky on stage and extinguished in exits. The fire caused by explosion of gas on stage during a performance. Number of lives lost, 80; nearly all in upper gallery.

RING THEATRE, VIENNA, AUSTRIA. — BURNED DECEMBER 8, 1881.

Location, three sides on streets. Plan and arrangement very defective, especially the stairways. Construction generally very substantial, but a good deal of inflammable decoration in auditorium. Iron curtain warped by heat and not lowered. Inefficiency and lack of discipline of employés and theatre firemen. "Special exit" doors locked; keys and locks useless from rust. Gas turned off in exits. Special oil lamps in exits removed, contrary to law. The fire caused by explosion of gas on stage just before performance. The defect which caused the explosion was known to exist. Number of lives lost, 386.

OPERA COMIQUE, PARIS, FRANCE. — BURNED MAY 25TH, 1887.

Location, three sides on streets. Construction in the main substantial, but not fire-resisting throughout, and with some very weak points. Plan and arrangement intricate and faulty. Exit for about half the ballet and supernumeraries by a wooden bridge over the upper part of stage. Iron curtain not lowered. Gas extinguished in exits. The fire caused by scenery catching from gas-lights. Number of lives lost, 70, the larger proportion of them in the upper tiers and on the stage.

EXETER THEATRE, EXETER, ENGLAND. — BURNED SEPT. 5TH, 1887.

Location, in an open square. Plan and arrangement fair, except that upper gallery had but one regular exit, and that badly arranged and obstructed. Construction inferior and not fire-resisting. No fire curtain. Inadequate provision for extinguishing fires on stage. Stage crowded with scenery. The fire caused by scenery catching from gas-lights. Number of lives lost, 166; mostly in upper gallery.

"The mean duration of a theatre in Europe is twenty-two years and a half; in the United States, ten years." J. A. F.

SOCIETIES

TECHNISCHER VEREIN.

AT the annual meeting of the Technischer Verein (German Technical Society), of New York, held October 8th, the following officers are elected:

President, G. W. Wundrain, M. E.; vice-president, E. A. Gieseler, C. E.; corresponding secretary, H. W. Fabian, architect; prot. secretary, E. L. Heusner, M. E.; treasurer, A. Drögmundt, M. E.; librarian, P. Schmaltz, M. E.; trustees, P. Göpel, C. E., H. B. Roelker, M. E., L. Portony, M. E.; chairman of Section I, civil engineers, W. P. Gerhard; chairman of Section II, mechanical engineers, O. Fuller; chairman of Section III, architects, R. Stricker; chairman of Section IV, chemists, Dr. M. Fiedler.

The number of members at present is: Section I, 48; Section II, 101; Section III, 35; Section IV, 34: total, 218.

H. W. FABIAN, *Corresponding Secretary.*

COMMUNICATIONS

A CORRECTION.

NEW YORK, October 17, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — Page 187, "Architects should Consult Specialists," last line, first word, "also" should read "almost;" thus reading: "one might almost say necessarily."

Very truly yours, ALFRED R. WOLFF.

THE NEW YORK SCHOOL-HOUSE COMPETITION.

ALBANY, October 11, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — I have noticed your editorial comment upon the proposed competition among architects in the presentation of plans for low-priced school-houses in this State. The provision limiting the competition to architects residing or having business in New York was put in without much consideration. Your suggestions relative to the matter have led me to think more fully of it, and I have determined to remove the limitation. What we want is the greatest progress in school architecture, and it makes little difference where we get it from. In fact, I apprehend the matter has been more fully considered outside of this State than in it.

I am grateful to you for your editorial approval of the scheme. I know that there are some elements in it objectionable to architects, but it was the only plan which we could devise which gave promise of producing what we wanted. The money prizes are comparatively insignificant; the real prize will be the satisfaction of success in the competition, and of having done something for a very important cause. Our appropriation was limited. We could have employed one or two architects to have furnished these plans. Then every other architect would criticise them. I trust that you will help us. I know that you can do so very greatly, and your paper indicates your desire. Very sincerely yours, A. S. DRAPER.

[WE may suggest that, besides the honor of winning in the competition, and the satisfaction of having been of service to the community, a young architect who should take the time and trouble to study and compare the best school-house plans of all countries would store up in his mind information which would probably be of the greatest value to him in future. No department of practice needs special knowledge so much as the designing of schools, and, although school-houses are too often entrusted to ignorant and inefficient architects, the services of the men who are known to be experts in the art of planning them well are in constant demand. — EDS. AMERICAN ARCHITECT.]

THE PNEUMATIC PARCEL DELIVERY.

MINNEAPOLIS, MINN., October 5, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — I noticed in the September number of the *Architect* a description of the pneumatic parcel delivery for New York. If you can conveniently send me the name of some engineer employed by them, or some person who has their ideas mapped out, I would be greatly obliged. I have drawings of my idea of how such a

pneumatic tube could be run, and overcoming all the difficulties of stopping at the several stations *en route.* I should like to communicate with them. Very truly, W. D. Kimball.

[We do not remember the name of the engineer of the New York Pneumatic Parcel Delivery, but it can probably be easily obtained from the New York directory. However, as pneumatic transportation has been in use for many years in London and Paris, for sending city letters from one station to another, and in the large telegraph offices here for transmitting messages to the operating rooms, we suppose the system must be now tolerably perfect. — Eds. American Architect.]

Notes and Clippings

The Value of London's Soot. — Fifty thousand tons of soot are taken from the chimneys of London annually. It is valued at $200,000, and is used for fertilizing purposes.— *Manufacturer and Builder.*

The Venetian Gondoliers and the Steamboat. — There is something very pathetic about the recent gondoliers' strike at Venice, now ended. The penny steamer is relentlessly improving the most graceful craft in existence off the face of the Venetian lagoon. They can scarcely last much longer. Nature had, for a long time, kept the taint of the railway out of Venice; but once steam made its way into the canals, the conclusion was a foregone one. The case of the gondoliers is peculiarly hard; even utilitarianism should pity them. A few years ago they numbered as many as 2,000 out of a population of 120,000. That was before the French company started the steam launches. Since then, year by year, their number has been reduced. The reduction is not made by circumstances, but by the action and arbitrary interference of the municipality. The steam launches are ruining the old trade. The one little bit of monopoly they possessed was the subject of the last blow struck at them by the authorities. Many trains come into Venice after sunset, and the steamers were not allowed to ply at night. The municipality removed this prohibition, and the poor gondoliers struck. — *Boston Herald.*

A large American Wine-Cask.— The monster wine-cask, owned by the Lenk Wine Company, Toledo, O., holding 36,000 gallons, and resting in a cathedral-shaped vault in the wine-cellar, has been in constant use since its completion in 1883, at a cost of $5,000, irrespective of the specially-prepared vault. It is on record that a cask was built at Heidelberg to contain 47,000 gallons, which quantity it held but once, as it was a failure and could not be refilled, while at Vienna a 41,000-gallon cask proved a fiasco at the first trial, and has since been a curiosity in innocuous desuetude. The Toledo cask, however, is now filled to the brim. It is 21 feet long, and 20 feet across the head, which is saucered-in, to withstand the immense outward pressure. The staves are 6-inch square beams of Kentucky white oak, clasped in iron arms attached to steel bands. Their convexity is about that of the ordinary cask-stave. The concave head is 8 inches thick, and formed of 6-inch beams, strengthened by 3 cross-beams, the central one being 18 inches thick. It is said that a Kentucky mill was 3 years in getting the timber suitable for its construction, owing to the extreme care necessary in its selection.— *Northwestern Lumberman.*

Isothermal System of Building. — This new system of building (according to the *Deutscher Dachdecker*), is principally based upon the employment of iron in layers between which isolating agents (air and materials of organic composition) are alternated in such a manner as to effect complete protection against cold as well as heat. The various parts of the building being constructed in factories, expedition and cheapness are insured. There is comparatively little brickwork, it being only used in the cellars, foundations, and chimneys. As soon as the last coat of oil-paint is dry, the house is ready for occupation. The building of such a house takes four or five weeks, and can be carried on in winter as well as in summer. The inventor of the system, Herr Hielemann, of Berlin, claims, moreover, that it insures complete dryness, and a saving of about one-third in the cost of building. It is, however, only applicable to structures not more than two stories high, such as agricultural and industrial buildings, dwelling-houses, villas, workmen's dwellings, etc. Cottages with two rooms and cellars, etc., can be erected for 112*l.* 10*s.*, this sum including stove, painting, paper-hanging, etc. Villas with five rooms cost 240*l.*, and with eight rooms, 450*l.* Sheds, stables, and similar erections can be put up from 1*s.* per square foot of surface built over. The use of oil-paint give these structures a cheerful appearance. A building executed on this plan may be seen at the Berlin goods station of the Potsdam Railway.

Paris Pavements — Many of the Paris streets are paved with wood, and it is considered that the "macadam" and "asphalte" will be replaced in time by the same material in every part of the metropolis. The history of the paving of Paris is curious. Stone was first adopted in the time of Philip Augustus. It was cheap, good for traffic, and did not cost much for repair; but its political uses were made amply evident in times of revolution, and Victor Hugo dignified or poetized it by calling it the "last resource of the people." This was comprehended by the Ædiles of the empire, who used "macadam." Next came "asphalte," which was bad for horses; and at last we have the wood paving, which Balzac was the first to recommend with enthusiasm. Unfortunately, in these days of petroleum, either wood or bitumen is, from a political point of view, worse than stone, and a journalist of repute pointed out five years ago that, in the event of another commune breaking out, the petroleuses from Belleville and Charonne would be able to make a larger and more effective bonfire than that which they piled up in 1871. The people of the Rue de Rivoli, however, do not agree with this, as they have petitioned the municipal council to give them wood, as the traffic makes less noise upon it than upon the "asphalte." — *Boston Herald.*

Loss of the Cork Model of Boston.—Even more curious, says Taverner in the *Boston Post,* was the disappearance of that ingenious piece of work, Duchesne's model of the City of Boston, with its cork houses and churches as tall as one's finger, covering a space about as great as that of a fair-sized drawing-room. The Boston of this model dated, I believe, about 1817, and it was in existence down to the time of the great fire. Before that, however, it had passed through some strange adventures, having been lost for a time and rescued on the Island of Hayti. Here in Boston the model was on exhibition for several years; at one time, as I remember, in a house on Bedford Street, near the corner of Rowe Street, and afterwards in the attic of the Historical Society building. The person who had it in custody sent a teamster one day with an order for the boxes in which it was packed to remove them to another place of storage. The teamster got the boxes, and from that moment Duchesne's model vanished from the face of the earth. The boxes were not delivered at the place designated, the teamster could not be found, and three months later the great fire swept the city. It is supposed that the model may have been put on storage in some building in that part of the city that was burned over. If this supposition is incorrect, and the model still exists, boxed up and unrecognized, here, too, is a chance for the lucky speculator who shall discover it.

Trade Surveys

Even should only five thousand miles of railroad be constructed next year instead of ten thousand, none of the disastrous results predicted by financial writers of daily and trade journals need necessarily happen. The new supporting factor in the industrial system of to-day is the diversification of industries and the great and increasing demand they will sustain for staple agricultural and manufactured products. What is lost in one direction will be made up in others. Next year's boat and ship building will be twenty-five per cent greater than this year's construction, according to reasonable guesses. Railroad bridge-building will be greater. Car and machine shop building will be enormous, and the pipe, tool, implement, and shop equipment demand must of necessity be enormous. It may be true that one thousand million dollars have been sunk in temporarily unremunerative channels, but if so, this signifies nothing in casting up the book-keeping accounts of a decade. The tendency of such expenditure is to reduce prices and indirectly conserve the best interests of consumers. The real estate speculative craze has already received a needed check, even though no harm is as yet threatened from such a craze from the standpoint of political economy. Freight and passenger rates on railroads will decline slowly. Trade combinations, which to many are so threatening, will do no harm, and even the Trusts of which so much fear is expressed as to their effects on honest competition will do very little of the predicted harm. Things which look harmful, on near approach are harmless. The strides of monopoly are quietly preparing the way for the inauguration of mighty reforms. In trade matters building material of all kinds is abundant. Bar-iron is quoted at mill at 1.8 to 2 cents; nails at $2 to $2.10. Crude iron is sold at Pennsylvania furnaces at $17 for standard forge; number 2 foundry at $19; number 1 at $21; skelp-iron is 2 cents; plate-iron 2.3 to 2.5. Merchant steel is in active demand at firm prices. The crude-iron production is quietly increasing, but in Eastern Pennsylvania a scarcity of coal and coke threatens the blowing-out of several furnaces. In the lumber trade immense quantities of lumber are coming forward; yards East and West are still very well stocked. Dressed stock of all kinds is selling well, but Michigan uppers have declined $1 to $2 per M in Atlantic markets. Lath and shingles are in very abundant supply and have declined. Yellow-pine receipts have been large, but prices hold their own. The planing-mill interests in the Northwest have combined, and prices are to be improved. Red-wood from California is coming into more general use, and Southern cypress and sap are also receiving much consideration. All hard woods are in active request, and prices are favorable to its more general use in building. The scarcity in anthracite coal, caused by the strike in the Lehigh region has not depleted supplies to the extent anticipated. The production for the last week reported was 731,000 tons against 758,000 tons for same week last year. The production this year is 2,532,795 tons in excess of last year. All of the bituminous regions are shipping large quantities. When the fields now opening begin to ship coal a sharper competition will probably be developed since facilities are expanding more rapidly than consumption demands. Late reports from the leading locomotive works of the country show that the volume of business is still very heavy and that railroad companies are seeking to fully equip themselves with locomotive power. The same continues true as to rolling stock. The orders for railway equipments and machine-shop machinery for the past four weeks exceed the orders of any other month this year. The improvements which are being made in machinery are leading to a weeding out of much old machinery, and there is a general improvement in the line of equipments of mills, shops, and factories. New England States, from an industrial standpoint, are in a decidedly better condition than twelve months ago; fully forty per cent of the invested capital is earning from one to three per cent better dividends. There are, of course, numerous exceptions, but taking invested capital in the aggregate, the improvement is of such a marked character over a year ago as to stimulate a great deal of building enterprise, not only in textile manufacturing, but in machine, paper-making, hardware production, and in a number of lesser industries, whose operations it is not easy to keep in sight. The latest reports from the leading industries of the Middle States show that the expansion of capacity that has been effected during the past year or so will not be rashly increased. So many new industries are springing up in other sections that progress in these States will be made with more care. A vast amount of money is seeking investment in manufacturing enterprise further West and South, which renders it necessary for New York and Pennsylvania enterprise to go slowly. It may be true that railroad building in the Western States will be placed under some sort of check, but even conservative railway managers say it is altogether a matter of guess-work to predict what will or will not take place next year. Much of the opinion expressed as to decadence of activity is based upon the old notion of the necessity of recurring panics. There is a larger out-going population from the Eastern States than is recorded in the columns of newspapers. This outgo will exercise a very marked influence upon the industrial trade conditions of the country. The population is thrifty, and their outgoing is an advantage to themselves and the trade in general.



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CONTENTS

TWO distinguished French architects have recently passed away. One of these, Daniel Ramée, who died in September last, at the age of eighty-one, was one of the most industrious and useful of the older men in the profession. Although a thorough artist and archæologist, he was also a most practical and sensible constructor, and, in addition, an accomplished man of letters. To his skill in archæology, and his appreciation of the beauty of mediæval work, he owed his appointment to the charge, successively, of the restorations of the Cathedrals of Noyon, Senlis, Beauvais and Abbeville, four of the noblest works which the thirteenth and early fourteenth century produced. During the few leisure hours which these important commissions left him, he found time to write some extremely useful books, on a variety of professional subjects. The best known of these is perhaps the "*Historie Generale de l'Architecture en France,*" covering the Romanesque, Mediæval and Renaissance periods. This was followed by an admirable little work on "*Architecture Pratique,*" and a dictionary of technical terms in French, English, German and Italian. The other architect whom the profession has to mourn is M. J. M. A. Le Soufaché, a man particularly noted for his success in the design of private houses, but highly esteemed also among his brethren for his accomplishments and honorable character, who died recently at the age of eighty-three. According to *La Semaine des Constructeurs*, he was at one time associated with M. César Daly in the editorial management of the *Revue Générale de l'Architecture*, and, after his graduation at the School of Fine Arts, was engaged in teaching at the school, as assistant to his patron, Duban. On entering, later, into active practice, he soon gained a high reputation, and, as M. Daly says, he may be considered the veritable founder of modern house planning, with its complex adaptations to the material wants and habits of the present day. He received in 1874 the prize of the Societé Centrale des Architects for domestic architecture, and was for many years prominent in that Society, holding various offices in it. By the public authority his merit was recognized in his appointment as one of the permanent jury of the School of Fine Arts, and by the decoration of the Legion of Honor.

LA SEMAINE DES CONSTRUCTEURS raises a question of great importance to builders, and in a less degree to architects and owners. One of its correspondents writes that he had made a contract with a builder for some important work, to be carried out on an estate which has not yet been provided with a water-supply of any kind, not even a well existing on the place, and that after all the papers had been signed and materials brought together for commencing the work, the builder had surprised him by demanding that he should be furnished with a supply of water for building purposes. Most of us know the shock which a proprietor experiences at learning of such extra demands after he has signed his agreement, and *La Semaine's* correspondent asks whether he is bound to comply with the request, or whether the builder's contract does not imply that he is himself to furnish water as well as the other materials for his work. The reply, which in this case is furnished by that most experienced and judicious writer on practical matters of business, M. Detain, shows that the question of water is regarded in France just about as it is here, and what is law there is certainly good precedent in this country.

IN brief, he says that the furnishing of the water necessary for their work is generally held to be the duty of the contractors. They are paid for their mortar, the cost of which enters into their estimate, and they cannot collect an extra charge for the materials required for making the mortar. If the circumstances of the locality in which the work is to be carried on are likely to make it difficult to procure water for building, it is for them to ascertain the fact, and consider the increased expense in their estimate, just as they would consider difficulties of transportation, or any circumstances likely to affect the cost of the other materials to be used. In most cases of the kind, the contractor would simply dig a temporary well, which is not a very serious matter, and would, if he were experienced in country building, include the probable cost of this in his estimate, but it happens sometimes that a city builder, who has been accustomed to have a service-pipe carried from the street-main into the cellar, and to pay only for the water used, forgets that water is not always so easily obtained in remote country districts, and, when he discovers his omission, tries to remove to the owner's shoulders the responsibility for his own carelessness. With us the water question is often of very great importance. We once knew a case where a public water-supply had been introduced into the town where a certain building was to be erected. After the manner of Water Boards, many promises had been made that the mains should be laid at once in the street passing by the property, and a service-pipe put in. The builder trusted these promises, as did also the owner, but the latter warned the contractor that he would not guarantee the promises of the Board, and, in the end, the unfortunate builder was obliged to bring all the water which he used in barrels from a spring at a considerable distance.

THE advantage of knowing something about a subject seems to us to be exemplified with unusual plainness in certain points in the report of the Park Commissioners of Boston for last year. The Boston Park Commission has for several years employed Mr. Frederick Law Olmsted as its professional adviser, and the wisdom of its choice is every year more fully shown. Among the other difficult problems presented to Mr. Olmsted for solution was lately one in which he was requested to devise a method of utilizing as a public park a strip of ground bordering on the river, or inner harbor. The territory slopes gently to the water, but is very narrow, directly exposed to the fierce northwest winds of winter, and has a background of manufactories and shabby houses. To convert this region into a beautiful public park would puzzle most persons, but Mr. Olmsted, with characteristic originality, invented a method of dealing with it which is worth remembering, Obviously, the water view presented the most attractive feature of the plan, and this was taken advantage of by the provision of a promenade, half a mile long, directly at the water's edge. Between this and the city tenement-houses flowers would hardly grow, on account of the exposed situation, while grass would soon be worn into shabbiness by the rather unruly population of the district. Nothing in the way of available vegetable ornament was left but trees, and Mr. Olmsted therefore planned to have the whole space between the promenade and the boundary of the park on the city side filled with trees, forming a sort of picnic grove, which could dispense with grass, and yet be beautiful, as well as useful in screening the promenade from the city dust and noise. To avoid too much monotony, an open space is left at each end of the long grove, in one of which

women and children will find opportunities for play and exercise, while the other, nearly half a mile off, is devoted to gymnastics for the rougher sex, which will thus be kept away from the women's and children's quarter. Nothing could be simpler, or more obviously sensible and suitable, than this scheme, and yet, simple and appropriate to the circumstances as it is, there are very few men in this country, not more than three or four, we should say, who would have thought of it, or who have even any notion of the professional tact and experience needed to solve such a problem so perfectly, and with so little affectation.

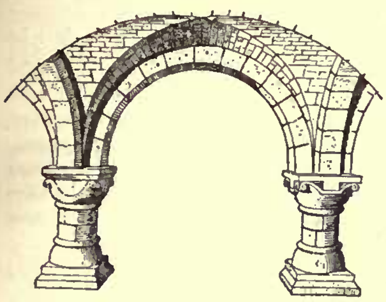
THE *Revue Industrielle* gives a table, copied from *Engineering*, of the proportions of ingredients in various high explosives. The ordinary dynamite, as most persons know, consists of three parts of nitro-glycerine to one of "fossil meal," a fine, soft earthy deposit, consisting mainly of microscopic shells. Dualin contains eight parts nitro-glycerine to two parts of gun-cotton; "rend-rock," or "lithofracteur," has forty parts nitro-glycerine, and forty of saltpetre, to thirteen parts of cellulose, and seven of paraffine. Giant powder contains thirty-six parts of nitro-glycerine, and forty-eight of saltpetre, to eight of sulphur, and eight of charcoal. "Hercules powder" is made of seventy-seven parts nitro-glycerine to twenty of carbonate of magnesia, with a little cellulose and nitrate of soda. Blasting gelatine consists of ninety-two per cent of nitro-glycerine, in which eight per cent of gun-cotton has been dissolved; and "forcite" gelatine contains about the same amount of nitro-glycerine, combined with ordinary cellulose. The American explosive known as "Rackarock," which was used with success in the Hell-gate excavation, differs radically from nearly all others, being made of seventy-seven parts of chlorate of potash to twenty-two parts of nitrobenzol. Either ingredient is tolerably stable when kept by itself, and in use the two parts are sent out separately, and mixed as wanted. A very singular use of high explosives has recently been made in France, in the course of the construction of the fortifications around Lyons. A portion of this work consisted of masonry, which it was necessary to lay on a foundation of soil filled with springs. The water came so rapidly into the excavations as to wash the cement out of the concrete put in for footings, and there seemed to be nothing to be done except to enclose the work with sheet-piling, and keep it dry with pumps. In this emergency Captain Bonnefont, of the Engineers, conceived the idea of forcing back the water from the trenches by the expansion of gases from exploding substances. He therefore had holes made in the ground with a long crowbar, about an inch and a half in diameter, and ten or twelve feet deep. In each hole was placed a string of dynamite cartridges, which were all fired at once. The explosion made a pit three or four feet in diameter around the hole, but the ground-water was forced far back in the pores of the earth, and did not begin to reappear in the excavation for half an hour or more. This gave ample time for the workmen to excavate the trench in the neighborhood of the pit formed by the explosion, and put in the concrete footings, which, by the time the water had again accumulated around them, had set sufficiently to be out of reach of harm.

WHETHER justly or unjustly, the French frequently accuse the Germans of counterfeiting trade-marks and other objectionable practices. The last account of the kind, which seems to be tolerably well authenticated, comes from the French journal *Métallurgie*. Not long ago, it seems, a certain German rolling-mill undertook contracts for furnishing steel rails to various roads at home and abroad. In Europe, as here, the railway companies appoint inspectors to examine new rails at the rolling-mills, test them, and reject all that fall below the standard required by the specifications. In this case, the inspectors, to make sure that their directions were followed, had private stamps made, with which they marked the rails which they found satisfactory. The directors of the mill, however, finding that their profits would be increased if they could palm off inferior metal on their customers, devised means for evading both the tests and the marks. One of the severest trials to which the rails were subjected consisted in letting fall upon them from a height a heavy block of iron. For this test the rail to be tried was placed on supports, and it seems that cushions of India-rubber were introduced into the supports, where they could not be seen, but served to lessen very materially the shock produced by the falling body. Not content with this evasion of a serious test, the mill-proprietors had punches made, in imitation of those used by the inspectors, and utilized them for stamping the rails which the inspectors had rejected. As suspicion would have been excited if the number of rails marked had greatly exceeded that of those inspected, the mill-owners took the precaution to keep a number of good rails on hand for testing. When the inspectors were ready, these were brought forward, tried and duly stamped. As soon as the inspectors were gone, an equal number of bad rails were stamped with the counterfeit punches, while the genuine marks were filed out of the good ones, which were placed in a convenient position to be again tested, stamped and utilized for passing a fresh batch of bad material.

ONE of the most curious of the new safety devices which have been applied to theatres in Paris since the destruction of the Opéra Comique is an iron curtain, moved like a hydraulic elevator, which has just been put into the Théâtre Français. This is a small, but old theatre, probably not too solidly constructed, and it must have seemed particularly necessary to provide some efficient protection between the stage and the auditorium. This has been done in an admirable manner by the construction of a curtain, or rather, a screen, of sheet-iron, stiffened by a frame of iron bars and braces, and decorated by painting on canvas attached to it, and sliding vertically. The sides of the screen are secured to vertical shafts, which form the pistons of two hydraulic presses, exactly like those of a direct-acting water-elevator. On opening a valve, the water is admitted under the piston, and the curtain is raised; and another valve, or rather, a different movement of the same valve, opens the discharge pipe, and the shafts sink, carrying the curtain with them. All this is infinitely better than the old-fashioned iron or wire-gauze curtain, hoisted by a rope and windlass, but M. Edoux, the engineer of the apparatus in question, has made a further improvement of great value by arranging the valves in such a way as to be controlled by electricity, and a current can be sent from various places on the stage and in the auditorium, as well as from the outside, which will lower the curtain in case the persons appointed to that duty should, as happened at Nice, at Exeter, and in the Opéra Comique, forget or neglect what was required of them.

A REPORT has been printed in the newspapers, to the effect that the persons having in charge the matter of the new Episcopal Cathedral for New York had bought a tract of land on the West side of the city, as a site for the building. The rumor is now contradicted, although it seems quite possible that ground in the position mentioned may finally be selected. In point of fact, there are many fine sites for such a building in the upper part of New York. Just above the Central Park a rocky ridge runs north and south. The southern part of the ridge slopes rather gently westward to the Hudson River, but is bounded eastward by a precipice, overlooking the plain of the Harlem Flats. The flats are now nearly covered with handsome houses, but the precipice of rock cannot be built upon, and has been taken possession of by the city, a long parapet wall built, and the summit converted into what is known as Morningside Park. The high land on the top of the ridge, just back of the strip of Morningside Park, is occupied by two or three charitable institutions, an orphan asylum and a lunatic hospital being the principal ones. Either of these corporations would gladly sell their land, now become of great value by the increase of population of the city, and either site would be an admirable one for a great public building, which would be visible from Long Island and the New Jersey shore, as well as from the lower portion of the city. The elevated railway, the principal thoroughfare of upper New York, runs over a long viaduct, some seventy feet high, parallel with the precipice of Morningside Park, and would give an unobstructed view of the eastern portion of the great church. Next to this situation, perhaps the Jumel tract, three or four miles further up town, presents the greatest advantages, but Morningside Park is nearly in the centre of the Manhattan Island, and will soon be about midway between the great northern railway terminus and the steamer and ferry-boat landings at the south part of the town, so that it is particularly favorable on this account, independent of its topography.

AMERICAN INSTITUTE OF ARCHITECTS.



THE Institute's Twenty-first Annual Convention was called to order Wednesday morning in the rooms of the Chicago Literary Club in the new building recently erected by the Art Institute in Chicago, Ill. President Walter being detained by illness, the chair was taken by Mr. Edward H. Kendall, of New York, vice-president, who delivered the following address:

PRESIDENT'S ADDRESS.

Having known for only two or three weeks that, owing to serious illness, our esteemed president, Mr. Walter, could not be with us to-day, I can do little more than call you to order, and formally endeavor to perform the duties of chairman. I shall ask you, however, to undertake the business of this, our Twenty-first Annual Convention, with that especial dignity of bearing and soberness of purpose which would seem to be called for upon the attainment of our corporate majority, and will remind you that we are called together, in this great and prosperous city, for the purpose of exchanging our annual greetings, of renewing our allegiance one to another, of giving evidence that we are competent to do the work required of us, of investigating the current developments in the science and art of our profession, and of increasing our usefulness to ourselves and to our clients in all possible ways.

We shall listen to papers from representative men upon subjects of especial interest, and reports of important committees must be heard and acted upon.

One of the greatest difficulties encountered by your Board of Trustees, now that our field is so much enlarged, is the frequent meagreness of information concerning candidates for membership, and, in order to reduce this difficulty to a minimum, must we not soon devise a better method than the present one of determining whether or not those who wish to join us are qualified by education, by business habits and by personal characteristics to so influence public opinion that we may command the respect and confidence of the several communities in which we work? Whether the present method can be made sufficient by a keener sense of responsibility on the part of those who know the applicants for fellowship or associateship, or whether we should create an office in the nature of a travelling secretaryship, the duties of which would be to come in personal contact with all our members and would-be members, and, by intercourse and correspondence, to make the Institute more surely a common ground where the best instincts and interests of our profession should centre, is a subject which we ought soon carefully to consider.

We must all feel gratified by the growing interest taken in our Institute, which is clearly shown by the unusually large number of applications for membership, and of requests for information as to the organization of additional chapters during the past year, and you will all bear me out when I say that we are especially glad to have admitted so many who are also members of the Western Association of Architects. It is our wish to have the active co-operation of all the best men in the profession, and the being a member of other associations or societies, instead of being a bar against, is, in fact, the very best reason for joining the Institute, as it would then get the benefit of doubly-organized work, and the general welfare would be correspondingly advanced.

Then, again, we wish to see and personally know all those who are doing good work in this great country, and the day will soon come when these annual meetings will be eagerly looked forward to and be largely attended, and when they will be considered not so much from the standpoint of duty as from that of pleasure and privilege; then, also, will the American Institute of Architects accomplish its highest degree of usefulness when it becomes the chief vehicle of professional pleasures as well as of professional duties, and when, to the formal requirements of routine and committee, are generously added the fraternal leaven of impulse and comity.

There were present on the platform, Messrs. A. J. Bloor, secretary, and O. P. Hatfield, treasurer, both of New York.

BOARD OF TRUSTEES.

The secretary read the report of the Board of Trustees. It showed that they had held nine regular and one adjourned meetings at the rooms in New York since the last convention. There had been twelve fellows and fourteen associates elected to membership, and the Board had now before it two applications for original membership and four for promotion. Appropriate mention was made of the death of Detlef Lienau, of New York City. The Board reported on the case where charges had been preferred against a member and they had been requested to ask for his resignation, that the By-Laws had not been complied with, and it had been thought best to reopen the case. New evidence had put such a different phase on the case that all papers had been referred to O. P. Hatfield, who had made an exhaustive report. The methods of securing additional funds were discussed, and it was thought best to recommend that a committee be appointed to make a report on ways and means before the convention adjourned. The formation of new Chapters at Washington and Indianapolis was announced. The activity of the W. A. A. in pushing a bill regulating governmental architecture, and the benefit which had arisen by concerted action with the Institute, were commented on.

The report was referred.

REPORT OF THE TREASURER.

Mr. O. P. Hatfield read his annual report. It showed:

Receipts, ...	$1306.35
Balance on hand October 1, 1886, ...	141.04
	1447.39
Disbursements, ...	1288.26
Now on hand, ...	159.13
Unpaid dues, ...	1478.00

He estimated the assets to be about $1,100 over the liabilities. The nucleus of the building fund was $236.75. The report was referred to an Auditing Committee.

COMMITTEE REPORTS.

The report of the Committee on Education consisted of a long article by Prof. N. Clifford Ricker, in charge of the architectural department of the Illinois Industrial University at Champaign. It was a description of the plan employed by him in his instruction.

The Publication Committee reported that 750 copies of the Proceedings of the last convention, as edited by Mr. Bloor, had been printed.

CHAPTER REPORTS.

The Chapters at Baltimore, Boston, Chicago, Cincinnati, Indianapolis, New York, Philadelphia, Rhode Island and Washington, submitted brief reports of work performed during the year. No great gains in membership were reported. New York reported that the Willard trustees had sent their agent to Europe on a collecting trip, and the fruits of it were to be placed in a room in the Metropolitan Museum of Art in New York City. The Secretary for Foreign Correspondence, Mr. W. L. B. Jenney, had nothing to report.

A NOMINATING COMMITTEE,

to nominate officers for the coming year, was appointed as follows: Messrs. E. I. Nickerson, Providence; Henry Lord Gay, Chicago; W. C. Smith, Nashville, Tenn.; Warren R. Briggs, Bridgeport, Conn.; N. C. Ricker, Champaign, Ill.

SPECIAL COMMITTEES.

The Committee on "A bill to provide improved methods in the architectural service of the Federal government in conference with a special committee of the W. A. A.," reported that the bill agreed upon which had been introduced in the last Congress by Hon. Abram Hewitt, had failed to be reported on by the committee to which it had been referred. It recommended, however, that efforts be made to have it introduced again in the next Congress. The report was accepted and referred.

For a report on "Architects' Protective Associations," a letter from Mr. T. M. Clark, of Boston, was accepted. It stated his inability to study into the subject as deeply as would be necessary in order to make a report.

The Committee on a "Permanent Home for the Institute," recommended the formation of a joint stock-company, with a capital of $500,000 in $100-shares, of which the stock should be held by the members of the Institute. This would erect a fire-proof office-building in New York, the top floor of which would be occupied by the rooms of the Institute, and the rest rented for offices to members of the Institute. It was believed that five per cent could be realized on the stock above expenses and reserves.

The Committee on a "Uniform Building Contract," reported that as a result of conferences with committees from the W. A. A. and the National Association of Builders, it had been decided to recommend to their different bodies the adoption of a resolution appointing a committee of three to confer with similar committees during the coming year for the preparation of a uniform building contract. The report was referred.

COMMITTEES APPOINTED.

A committee was appointed to act on the Trustees' report, consisting of Messrs. M. E. Bell, L. T. Schofield and D. Adler. A committee to audit the Treasurer's report was made to consist of D. H. Burnham, Charles Crapsey and J. J. Deery. A committee, to which all other reports should be referred, was appointed, to consist of J. G. Cutler, J. W. McLaughlin and John W. Root.

THE ASSOCIATION OF ALABAMA ARCHITECTS

sent a letter of greeting by its president and secretary, which was accepted and made a part of the minutes.

An invitation to visit a terra-cotta company's works was read.

Announcement was made that the exhibition of architectural drawings, which had been given Wednesday evening on the programme, was not forward enough to bear inspection, and that the Inter-State Exposition would be visited instead.

DISTINCTION IN MEMBERSHIP.

Mr. Adler called up the question of the distinctions between

fellows and associates, and offered a resolution that on and after this date all associates should be made fellows. The resolution was declared out of order, as it sought to amend the By-Laws without thirty days' previous notice having been given. Mr. W. L. B. Jenney moved that the question of equalizing the grades of membership, or of elevating the grade of fellow, be referred to the newly-elected trustees, and it was carried.

Mr. D. Adler, of Chicago, then read a paper on "Theatres," after which adjournment was had for the day.

LUNCH.

By courtesy of the Entertaining Committee, lunch was served informally at the Union League Club, after which drives about the city were tendered the visiting architects.

PERSONS PRESENT.

The following names were inscribed on the register: Edward H. Kendall, New York; O. P. Hatfield, New York; A. J. Bloor, New York; N. Clifford Ricker, Champaign, Ill.; D. H. Burnham, Chicago; Warren R. Briggs, Bridgeport, Conn.; Edward I. Nickerson, Providence; Henry W. Hill, Alfred F. Pashley, and S. S. Beman, Chicago; John J. Deery, Philadelphia; Fred'k H. Gouge, Utica, N. Y.; William S. Wicks, Buffalo; Samuel A. Treat, Normand S. Patton, Chicago; George A. Frederick, Baltimore; Otis Dockstader, Elmira, N. Y.; George W. Rapp, Cincinnati; Jas. G. Cutler, Rochester; Mason Maury, Louisville; C. A. Wallingford, St. Paul; Charles Crapsey, Cincinnati; John W. Root, L. D. Cleaveland, Chicago; C. M. Bartberger, Pittsburg; E. H. Taylor, Cedar Rapids, Ia.; Henry L. Gay, Chicago; Adolph Cluss, Washington; E. L. Walter, Scranton, Pa.; Louis H. Sullivan, Chicago; J. F. Alexander, Lafayette, Ind.; C. A. Curtin, Louisville; John Ord, Philadelphia; M. E. Bell, Chicago; W. Bleddyn Powell, Philadelphia; Wm. C. Smith, Nashville; C. G. Clark, Louisville; W. W. Clay, Chicago; Melvin P. Hapgood, Hartford.

SECOND DAY.

It was an hour and one-quarter after the time set on the programme when Chairman Kendall called the convention to order Thursday morning.

Secretary Bloor read letters from N. Le Brun and George C. Mason, Jr.

BY-LAWS AMENDED.

The following was added to the end of Article I., Section 5, of the By-Laws: —

The name of any honorary member resident in this country, who, after his election to that grade, shall engage in the active practice of the profession, shall not be afterwards printed in the roll of honorary members during the continuance of said active practice.

The following was added at the end of Article V.: —

No president of the Institute shall be eligible for consecutive reëlection to the annual term more than once, and presidents above the age of seventy, who have served for two years, shall, if they so elect, be exempt from the payment of annual dues, and be enrolled as honorary members, with the addition of the title of past president; and, in any case, shall continue to have all the privileges of the Institute, including that of voting.

A report of nominating committee was made, but as it contained the names of several associates, who, under the constitution, were not eligible for office, it was referred to committee on nomination for correction.

RESOLUTIONS.

Mr. James G. Cutler moved that a committee of three be appointed to draft resolutions concerning the indebtedness of the Institute to Thomas U. Walter, LL.D.

REPORTS OF COMMITTEES.

The special committee appointed to consider the report of the Board of Trustees reported, suggesting thanks to the Board for their labors, and that their report be placed on the minutes, and that its recommendations be taken up one by one, and considered by the convention. It recommended that the papers in the case of unprofessional conduct be placed at the use of the members. The report was accepted.

The committee appointed to audit the accounts of Treasurer Hatfield reported them correct. The report was accepted.

The special committee on consideration of other reports made a report which contained the following recommendations: —

1. That the chairman's address and the report of the committee on education be referred to the committee on publication.
2. That a form be devised, on which secretaries of chapters could make annual reports covering such information as was really important to have from each chapter.
3. That the reports which had been received from the various chapters be accepted, and the cause of the absence of reports from the chapters at St. Louis and San Francisco be ascertained.
4. That the committee on a Permanent Home for the Institute be continued and enlarged to five members.
5. That the report of the committee on a uniform building contract be adopted and its advice followed.
6. That the committee on "Architects' Protective Associations" be discharged, and that protection should be furnished from within the Institute rather than by legislation.
7. That the committee on the government architectural bill be continued, and Mr. M. E. Bell and another member be added to it.
8. That the report of the publication committee be accepted.

The report of the special committee was accepted.

Papers were then read. Mr. Bell, of Chicago, formerly Supervising Architect of the Treasury, read one on the "National Building Question." It was a summary of what the paramount requirements were for a building for government purposes should be. As a condensed statement of his four years' experience in the office, it was very interesting.

Mr. Charles Ham, of Chicago, assistant treasurer of Cook county, read a paper on "Manual Training as applied to the Building Arts."

Mr. W. W. Boyington, of Chicago, read a paper entitled, "Differences between the Methods of Architectural Practice prevalent now and fifty years ago."

REPORT OF COMMITTEE ON NOMINATIONS.

The committee on nominations here made a second report, which recommended these gentlemen for officers for 1887–88: —

President, Richard M. Hunt, of New York City.

Secretary, William A. Pattee, of New York City.

Treasurer, O. P. Hatfield, of New York City.

Board of Trustees: Napoleon Le Brun, of New York City; L. T. Schofield, of Cleveland, O.; Henry M. Congdon, of New York City; John W. Root, of Chicago.

Committee on Education: Messrs. N. C. Ricker, Champaign, Ill.; Alfred Stone, Providence, R. I.; Wm. R. Ware, New York City; J. W. McLaughlin, Cincinnati, O.; Henry Van Brunt, Boston.

Committee on Publication: Charles Crapsey, Cincinnati, O.; T. M. Clark, Boston, Mass.; S. S. Beman, Chicago, Ill.; George C. Mason, Jr., Newport, R. I.

Secretary for Foreign Correspondence, Arthur Rotch, of Boston.

These officers were elected.

An amendment to the By-Laws, by the adoption of which Associates will become eligible for office, was offered by Mr. Briggs, of Bridgeport, Conn., for action next year.

The Institute was invited to visit the Chicago Manual Training School.

The committee on nominations made a supplementary report, in which the proposed action for expressing to Mr. A. J. Bloor the indebtedness which the Institute owes him for continued services was gracefully sustained, and the report was accepted.

LUNCH.

The Institute then adjourned to lunch served by the kindness of the entertaining committees, at Kinsley's, after which carriages were taken, and the north division of the city visited by those who desired so to do.

The exhibit of recent architectural work, from which so much was expected, turned out to be rather small. Only the contributions from Chicago saved it from being a failure as an exhibit. Nineteen architects and firms from Chicago were represented. Nine outside architects sent contributions, the most prominent of which was the design for the custom-house at Detroit. The character of the work exhibited, as to style and rendition, was superior, and in those respects the exhibit was superior to any yet held in Chicago.

The exhibit of comparative drawing loaned by the *American Architect and Building News*, was a very interesting feature. Three other architectural journals loaned photographs, etc.

EVENING SESSION.

After thoroughly examining the exhibit, Chairman Kendall called the convention to order in the Assembly-room, and a paper was read by Mr. John Moser, of the Supervising Architect's office, on "Federal Buildings for Judiciary, Customs, and Postal Service." He described the process to be followed in developing the plans for a large government building, touched on the style which government buildings should possess, bringing out his somewhat well-known ideas as to the "melting together the quiet serenity of the Greek" and other styles, and followed his reading by suggestive black-board sketches.

THIRD DAY.

The chairman, in calling the convention to order, asked for the reading of a paper by Mr. D. H. Burnham, of Chicago, on "Suggestions towards the Best and Speediest Methods for Harmonizing and Utilizing all the Architectural Societies in the United States," etc.

After the reading of the paper, Mr. Burnham offered the following resolution, which was seconded by Mr. A. J. Bloor, and was unanimously passed: —

Resolved, That a committee of five members be appointed, of which the Chairman of this Convention shall be a member, *ex-officio*, the other members to be selected by him, to act jointly with one of similar number to be appointed by the Western Association of Architects at their next general meeting, and to report as to the best and speediest method of consolidating all the architectural societies of America into one organization; their report to be full regarding form and constitution for local societies, and also regarding form, constitution, permanent place of meeting, and proper quarters for the national or representative body.

That the Western Association of Architects be, and they are hereby cordially invited to unite with us in this work, and to appoint a committee as above.

The next paper was on "The Essential Features of a Large Opera House," by Mr. J. C. Cady, of New York City.

This was followed by a paper on "The Paramount Requirements of a large Library Building," by Mr. J. L. Smithmeyer, of Washington, D. C. In introducing the paper he stated these requirements to be: "Abundance of solar light, a generous provision of artificial light at night, plenty of pure air of a suitable temperature, well-designed protection against the ravages of fire and against the deleterious influences of dampness, proper ventilation, convenient interior arrangement, durability of building materials, and stability of construction." To these he added other important considerations of a suitable site, high and dry, plenty of distance between it and other buildings, ample provision for ingress and egress, ample opportunity to expand the book-holding capacity so as to postpone the enlargement of the building as long as possible, good sanitary arrangements and easy approaches. As to the evolving of a design and style, he said it should "wear the livery of good taste, and exhibit, even to unskilled eyes, its purpose." Different plans of book and room arrangement were fully described.

Mr. Geo. A. Frederick, of Baltimore, then read a paper on "Dining-rooms," treating of their adornment and decoration.

The next paper was on "The Line of Demarcation between Engineering and Architectural Practice," and was written by Mr. Joseph M. Wilson, of Philadelphia. He divided engineering into two classes, civil and military, with the latter of which we have nothing to do. He then divided civil engineering into specialties as transport engineering, hydraulic, sanitary, coast-works, mining, mechanical, electrical, bridge, and architectural. The pure architect begins where the engineer ends. All engineers cannot be architects, but all practising architects must be engineers, more or less. If he feels inability in this direction, he should associate with one who can supply the deficiency, and reserve to himself the artistic part of the profession. No strict line can be drawn between engineering and architecture. "The one is the prose, the other the poetry of the art of building."

COMMITTEES.

Chairman Kendall announced these committees: —

To prepare resolutions concerning ex-President Walter: J. W. McLaughlin, W. C. Smith, J. G. Cutler.

To make a blank form for Reports of Chapters: N. C. Ricker, W. G. Preston, and G. A. Frederick.

On a Uniform Building Contract: O. P. Hatfield, J. H. Windrim, Alfred Stone.

To indemnify Mr. Bloor for his eminent services: H. H. Holly, H. L. Gay, John Murdoch, Henry Van Brunt, Jas. B. Lizius, T. P. Chandler, Alfred Stone, Augustus Laver, H. G. Isaacs, and J. L. Smithmeyer.

The convention then acted on the recommendation of the Board of Trustees, that a committee be appointed to devise ways of raising more money, and referred it to the committee to be appointed in accordance with the resolution of Mr. Burnham.

The convention adopted the recommendation of the special committee that the reports of secretaries of chapters be made one month before the Institute's convention.

The convention decided to continue the committee on Federal architecture, as recommended by the special committee, adding Mr. Bell, and one member west of New York City to it.

A recess of thirty minutes was then taken for lunch, which was served in the rooms.

The committee from the Western Association on the metric system sent in a communication asking the Institute to resurrect its former interest in the subject. The communication was referred to the Board of Trustees, with power.

A letter was read by the secretary from Supervising Architect W. A. Freret, explaining his inability to attend the meeting and his regrets.

The Institute then went into executive session on the "unprofessional conduct" case.

Upon reopening the doors, various resolutions of thanks were passed, and the Institute adjourned.

At the close of the sessions the register showed the following additional names. It was, even then, not nearly complete: —

S. V. Shipman, Wm. Holabird, J. L. Silsbee, W. L. B. Jenney, W. A. Otis, D. Adler, John Addison, Aug. Fiedler, Alfred Smith, James R. Willett, all of Chicago; R. W. Gibson, Albany, N. Y.; S. R. Burns, Dayton, O.; John Moser, Washington; L. T. Schofield, Cleveland, O.; Jas. W. McLaughlin, Cincinnati, O.; W. R. Brown, Cincinnati, O.

CONCRETE FORTS. — We see that experiments are to be made shortly at Lydd as to the capabilities of a concrete turret to resist the impact of modern projectiles. A concrete tower is to be erected and covered with thirty feet of earth. We described a short time ago what a scientific French general had recommended as the fort of the future. This was an oval fort of concrete, shaped like a dish cover, without a ditch or flanking works of any kind, and having a thickly plated iron cupola in the center, armed with two or three heavy guns, and with disappearing turrets for quick-firing guns. These masses of concrete are pretty nearly solid, covering subterranean barracks and store-rooms, and they would require very small garrisons. We believe the Belgian defenses on the Meuse will partake something of this character. The heavy guns are placed in pairs parallel to one another in the turrets, and are turned away from the enemy when loading takes place. — *Broad Arrow.*

ARCHITECTURE AT THE PRESENT TIME AS COMPARED WITH THAT OF FIFTY YEARS AGO.[1]



A ROMAN FRAGMENT, — the Museum at Dijon.

FIFTY years ago is an earlier period than my experience as an architect extends; it was, however, in the early years of my studies in architecture. In order to demonstrate fully the progress of architecture during the last half century, would it not be well to compare its progress with some of the other arts and sciences; for instance, steam and electricity, as they are closely allied to architecture in the complete construction of buildings? Steam was better understood fifty years ago in this country than architecture or electricity. Architecture was then understood and practiced as a separate profession by very few persons. I think it is safe to say that there are more architects in practice to-day in the city of Chicago than there were then in the whole United States. I think it is also safe to say that with the exception of the science of electricity, architecture has made greater strides than any other of the arts and sciences. I claim that architecture combines both art and science to a greater degree than any other profession. To-day, we can vie with any country in the world in style and permanency of construction. Fifty years ago this country knew no style in architecture except the Classic and the Gothic, and but very few pure examples of either of those styles were executed in this country. The majority of buildings at that period were planned and built by master builders, who usually made their plans on the face of the trestle-board, and shaded them with white, red and blue chalk to designate wood, brick and stone. Details were made, full size, in the same way. My father was a master builder, and used to make his own plans largely in the way mentioned. Architectural works in that early period were but few. Foreign works at that day were very expensive. I recollect the works of Benjamin Hill, La Fevre, and a few other authors, not to exceed half-a-dozen, altogether. At the present time we have a very large number of architectural publications and upwards of three thousand practising architects. I trust a majority of them are doing a legitimate commission business, and are not mere tools of contractors. Fifty years ago, and even less, architects were largely supported by contractors. Now, and for years past, the owners have found it for their interest to deal directly with architects. Still there are many impecunious persons who think that it is money wasted to employ an architect so long as they can get the services of one through their contractor, when, by so doing, they do, as a usual thing, indirectly pay three prices for their plans. I think I am correct in saying that Philadelphia is the largest city in this country which can boast that it has more buildings built in the last fifty years in proportion to its inhabitants, without the employment of architects. They used to build miles of street fronts with builders to duplicate a certain mould with but slight variations to suit localities or notions of proprietors. That system, I am glad to say, is largely done away with even in Philadelphia, and architects' services are more fully appreciated. Still in Philadelphia there are, to-day, a less number of architects, per capita, than in any other large city. When I came to Chicago, thirty-four years ago, I found the architects then in practice were recent master builders or contractors. Chicago and the West at that time could hardly be said to require the services of architects, separately as such. At that time the structures were but simple buildings, but the builders soon found that it would be better for them to have plans made rather than to spend their time in making plans, so they clubbed together, and induced one of them most apt in drawing plans to give up his contracting and to devote his whole time to architecture, and guaranteed him a compensation of $2 per day, which should be paid to him if he did not get business enough to aggregate that amount. I have been told by a person who was acquainted with the early workings of the first architect of this city, that he had an order for a set of plans for a dwelling, which he made and charged $5 for them, and was much elated over the circumstance. From this small beginning others started, and on my arrival I was introduced by friends, or had letters of introduction to citizens, as a young architect from Massachusetts. This simply shows that as a profession it was not understood. It is not so now. No profession is better or more favorably known. Having mentioned the small compensation which architects were obtaining for plans, and that it came largely from contractors, I might state that when I commenced business in Chicago I immediately instituted the custom of charging a percentage on the cost of buildings as the only proper course to pursue, and always collected it from the owners. This departure was rather up-hill work, but I have plenty of witnesses now to show that it was a success. And from that small beginning we can, to-day, boast of as fine and as capable a corps of architects as any city of the Union, and the architect who first commenced practice in this city is still living. Chicago has been a sort of radiating point. My sphere of practice has extended from the Gulf of Mexico on the south, to Manitoba on the north, and from the Atlantic to the Pacific, together with the intermediate cities on the

[1] A paper read by W. W. Boyington at the Twenty-first Annual Convention of the American Institute of Architects.

lines from East to West and from North to South. How is it with other arts, sciences and professions? Have they kept equal pace? Railroads were but little known fifty years ago; the same with electricity. Steam-power was well developed, but the mechanism was very crude as compared with the present. Electricity can hardly be said to have developed into any practical use half a century ago. Consequently, I think we must give way to the scientific development of electricity. I well remember some few simple electrical experiments made by stringing wires around a town-hall, and, with a crude instrument and battery, a circuit was made around the hall and a few interesting experimental freaks were produced. From this small beginning the world has been brought together within speaking communication, and a power produced, yet in its infancy, which is destined to be improved to the wonder and astonishment of the world. Hence we must assign to it the place of the leading science of the past fifty years. While we accord this, we must not forget the very crude construction of railroads. First, the wood-stringer with iron strap rails, more familiarly known as the "snake-head" rail. On these rails the engines were constructed to run without tenders or covers of any kind to protect the engineer or firemen. They used to stand on the open platform exposed to the severity of the weather and storms. It was in the year 1840, I think, that I was called upon by the Master Mechanic and General Superintendent of the Boston & Albany Railroad to see if I could not devise some kind of protection at least partially to cover the engineer and firemen, and have it sufficiently open not to obstruct their view. I examined an engine and reported that I could construct a cover. I was at once employed to make the necessary drawings and superintend the construction of the first cab over an engine in this or in any other country. The result was a perfect success, upon which there has not been any material improvement, as it was almost identical with the cab now in use. I need hardly inform you that its use was immediately adopted throughout this country. Had I had forethought enough to have secured a patent for the device, I probably would not have been called upon to prepare this paper. I trust you will forgive me for diverging so far from the subject given me. The mention of these somewhat kindred subjects has been prompted by the incidents in my early life that were fastened so strongly in my mind in connection with my studies and practice in architecture.

ILLUSTRATIONS

[*Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.*]

BALMORAL CASTLE, SCOTLAND.

[Gelatine Print, issued only with the Imperial and Gelatine Editions.]

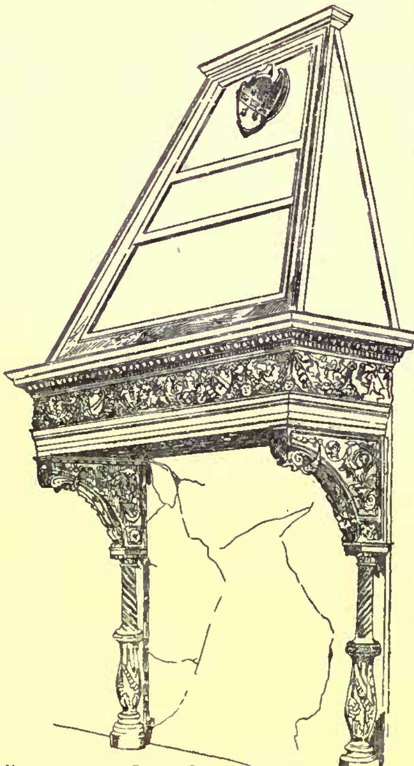
COMPETITIVE DESIGN FOR THE SYNDICATE BLOCK ON STATE STREET, BOSTON, MASS. MESSRS. BRADLEE, WINSLOW & WETHERELL, ARCHITECTS, BOSTON, MASS.

GREENWICH HOSPITAL, LONDON. AFTER AN ETCHING BY DR. SEYMOUR HADEN.

FOR the privilege of reproducing this subject we are indebted to Messrs. F. Keppel & Co., of New York.

NEW REGULATIONS FOR PARIS THEATRES. — The new Paris police ordinance concerning theatres requires that the building must have space or alleyways on the sides and back, or, if back to back with another building, a thick rear wall. The three parts of the theatre, auditorium, stage, and dressing-rooms and offices, must be separated by masonry walls. Ceilings and dome must be of iron and masonry. Doors from auditorium to stage must be of iron, and so must the rolling curtain, made in meshes. The curtain must be held up by non-combustible cords. Scenery must be uninflammable and tested twice a year. Work-rooms must be separate from the stage and auditorium. Stairs must be of iron and masonry, and of a certain prescribed width and number. There must be a lobby around each story of the auditorium. Theatres must be heated only by registers, with furnaces in the basement and pipes of earthenware. Gas may be used for lighting, but always with a tell-tale in each part of the house. Gasoline, mineral oils and hydrocarbons may not be used, but oil-lamps with glass shades, and kept lighted during each performance, must be sufficiently numerous to prevent total darkness if electricity or gas give out. There must be ample reservoirs of water and a hydrant with pressure to throw streams to the highest parts of each house. There must be fire-escapes on exterior walls, and means for telegraphing to nearest fire-engine house. Each theatre must have offices for police, physicians, service-guard and firemen. There must not be a smoking-room or any stores, unless the latter are permitted by the police. A commissary of police with a squad proportioned to the size of the house, a squad of firemen and a corps of physicians must attend each performance. The ordinance is so minute and complete that not a third of the requirements are included in the above digest, which gives only the more important prescriptions. — *Exchange.*

THEATRES.[1]



MANTEL IN THE DUCAL PALACE, VENEZIA.

AFTER DRAWING BY R. BARRATT IN THE ARCHITECT

AS we are all American practitioners whose work is confined within the geographical limits of the United States, and therefore within the financial and other limitations arising from our national peculiarities, I will make no effort to describe the ideal large opera house, of which so many examples exist in Europe, but will confine myself to the essentials and peculiarities of an American theatre and opera house containing upward of 3,000 seats, and capable of serving also as a concert or convention hall.

The site of our building should be an open square surrounded by broad streets; but in no case should a site be chosen which does not permit the disengagement of the building on at least three sides.

The construction of such a building should be of the most solid and enduring materials, so disposed as to produce a building as nearly fire-proof as modern science and art can make it. The ever-changing conditions of desirability of location so characteristic of American cities must be disregarded by making permanence and stability of structure paramount considerations.

In the disposition of space we are confronted by limitations which prevent the fulfilment of ideal requirements. Municipal aid is with us never extended to the building of an opera house, which must, therefore, be erected by private capital, of which it seems impossible to secure as much as is required for erection and maintenance without connection therewith some means of commercial utilization, so that a revenue sufficient for the maintenance of stage and auditorium during the many periods of disuse may be obtained.

This disposition of important parts of the ground, generally the street frontage, increases the difficulty of planning the lobbies, foyers and corridors, so desirable for a structure of this kind; but whatever the wants or necessities of the commercial adjuncts of such building, there should always be lobby space enough to hold almost the entire audience.

In determining the space to be assigned to the stage, it must be remembered that without suitable provision for presenting to the public scenic and dramatic effects on a far grander scale than can be produced in the ordinary theatre or opera house, there would be no justification for the existence of a building of the class which I am endeavoring to describe. And yet, too much space should not be assigned to the stage, as the commercial result of the enterprise must be kept in mind, and this requires a reasonable proportion between the cost of producing a good opera or spectacular theatrical performance and the size of the audience which can be drawn to see the same. We have no subsidy from municipal or general government to make good deficiencies which would arise from the cost of performances given upon a stage of the proportions found in the opera houses of the old world. Besides, we cannot in any city of our country maintain, still less carry with a travelling company, a permanent, well-trained chorus corps de ballet, or a corps of trained supernumeraries sufficiently large to fill a stage approximating in size that of a European house of the first rank.

A very large space should be assigned to the mechanisms for the production of scenic transformations and illusions. Nothing is more annoying to American audiences than the excessively long waits between acts so characteristic of operatic performances on a large scale as we know them on the American stage. And while the almost magic transformations characteristic of the stage of the Madison Square theatre are impossible of attainment under ordinary conditions, I believe that a happy mean can be found between these and the evil before referred to. One of the means of securing this end would be an effort to keep all moving and movable parts incidental to the production of scenic effects, transformations, etc., within reasonable bounds as to size and weight; and, as far as possible, to make transformations by upward and downward movement of the stage paraphernalia, by which means the horizontal dimension of the stage can be minimized, although great depth below and height above the

[1] A paper read by D. Adler, F.A.I.A., at the Twenty-first Annual Convention of the American Institute of Architects.


D.A.G.

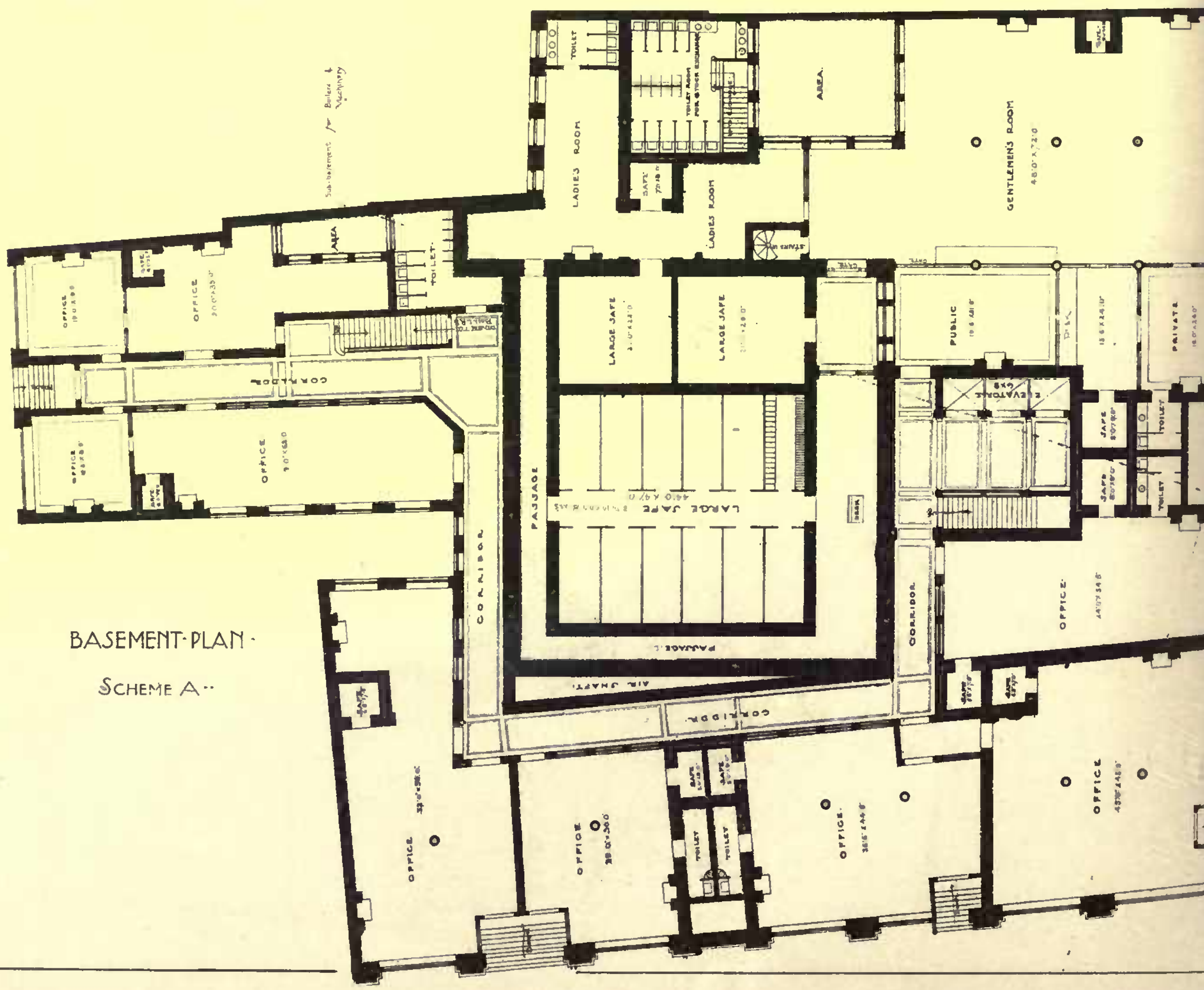


PROPOSED
NEW EXCHANGE BUILDING.
FOR THE
STATE STREET SYNDICATE
BOSTON.
BRADLEE, WINSLOW & WETHERELL, ARCHITECTS,
BOSTON, MASS.

Heliotype Printing Co. Boston.

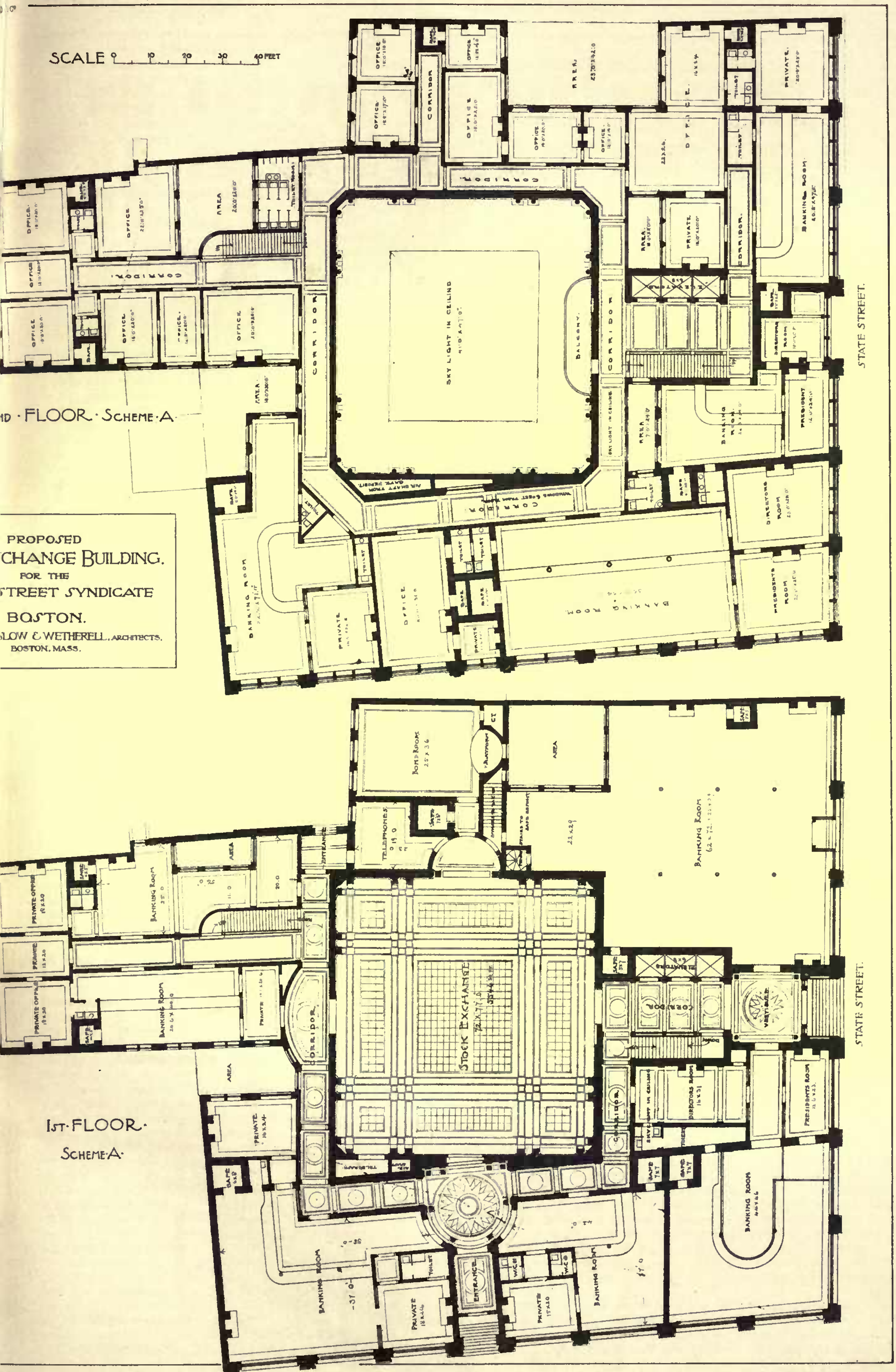


Elevation · on · State · Street ·



BASEMENT·PLAN·

SCHEME A··



Heliotype Printing Co. Boston.

stage floor would become essential. Liberal allowance of space for dressing-rooms, and for storage of scenes, properties and costumes must not be forgotten.

It is advisable to endeavor to secure at least partial sunlight illumination of the house, and thus avoid the expense of artificial illumination for daily cleaning, rehearsals, and for day-light assemblies, such as conventions, mass-meetings, concerts, etc., when scenic effects are not to be produced. This daylight illumination will almost invariably be imperfect, for corridors, lobbies, etc., and in many instances the business adjuncts of the building will cut off all means of illumination except skylights, and these can rarely be made sufficient to light up all parts of the house. Means must be provided to shut off, when necessary, all sunlight which might interfere with the realization of scenic effects.

Day and night illumination of the stage, when occupied for a scenic representation of any kind, must be by artificial light. Of the artificial lights known to us, the incandescent electric light is the only one to be seriously considered, in the design and distribution of which every effort should be made to secure a uniform and general illumination — a lighting up of all shadows under galleries, and an illumination which will reveal clearly all faces and toilets without bringing them into a trying glare. In arranging the lights of the stage it is necessary to see to it that the light falls upon the faces of the performers in such manner that there will be no shadows which produce distortions of their features. It is well, also, in arranging lights, particularly those on and immediately in front of the stage, to interpose reflecting surfaces which throw the light where it is required, and shut out its glare from the direct line of vision of the audience.

In the construction and laying out of the engines, dynamos and wiring for the electric light, an effort should be made by suitable sub-divisions to prevent the possible putting out of all the lights by any accident to the machinery or wires. The practice of European theatres in providing as a safeguard for such contingency a system of oil lamps or wax candles arranged and always kept burning around the walls of the auditorium and in all the corridors, is worthy of imitation.

The means of ingress or egress should, of course, be ample. No allowance of less than three feet for each two hundred persons in determining the width of aisles, doors and stairways, should be considered. A large number of narrow aisles is to be preferred to a small number of wide ones. Aisles should lead as directly as possible to doors. As before stated, the corridors and lobbies should be of sufficient size to hold more than one-half the audience. The stairways must have frequent landings, and the exits should be so disposed as to tend to disperse the audience as rapidly as possible.

Where audiences are very large the means of ingress become quite important, and every facility must be extended to those who purchase their tickets at the beginning of a performance, and these should be kept out of the way of persons who come already provided with tickets, and every means must be used to facilitate the entrance of the public into the building, and to prevent blocking up the halls, corridors, or stairs.

Heating and ventilation present unusual difficulties in a house of this kind. No dependence whatever can be placed upon doors and windows. The air must be warmed in winter and cooled in summer. A sufficient volume of air for comfort and health must be forced into and removed from the room by mechanical means. The temperature and hygrometric condition of the air admitted must be under perfect control, and the means for exhausting the air must be so arranged that the vitiated air in its progress to the exhaust ducts does not come in contact with the heads of any part of the audience, and that "draughts" are prevented. It is desirable, for acoustic effect, to have all air currents tending from the stage outward. It will be easiest to attain these ends if the fresh air is chiefly introduced at and from the top, and in greatest volume near the stage, and if the exhausts are in and near the main floor and in and near the floor of the various galleries and balconies, increasing in capacity with their distance from the stage. One-third of the air-ducts should open on the stage, but these ducts must be under the immediate control of the prompter, so that they may be closed when smoke is produced on the stage, and while the curtain is lowered, and turned again as the curtain is raised.

Wherever possible the galleries should be disengaged from the walls behind them so as to permit the free passage of air currents through the space covered by the gallery.

As a protection against drafts from outdoors there should be, if possible, at least four sets of doors between the chief lobbies and the outer air, and each of the spaces enclosed by these doors should be warmed.

The means of cooling the air for summer ventilation must be by refrigerator machines. It is impossible to handle successfully a sufficient quantity of ice for our purpose. In dusty and smoky cities an apparatus for washing the air before it is introduced into the building should be provided.

As it would be too expensive to call into use the means of heating provided by the ventilating system for the daily cleaning of the house and for rehearsals, there should be a sufficient quantity of direct radiating pipes and coils on the stage and in the auditorium to warm the house to a moderate extent. These would be used when the house is occupied except, perhaps, in the coldest weather.

Foremost among the necessary hygienic arrangements is the system of ventilation before described. Next in order are the plumbing fixtures and pipes, upon which even greater care must be expended than in ordinary buildings. During the periods of disuse to which houses of this kind are subject, the evaporation of water from traps, or the syphonage of traps, or leaks of soil or waste-pipe, would produce most disastrous results. These contingencies must, therefore, be guarded against with the utmost care. During these same periods of disuse in winter the danger by freezing of water in the pipes is a danger against which precaution must be taken.

The provisions against conflagration are a most fruitful topic. As it has been assumed that the general construction of our house must be fireproof, we have in this already a most potent safeguard against conflagration. If we carry this fireproof construction further, and use for the frame-work of the stage, stage mechanisms and paraphernalia, incombustible materials, and banish gas from the stage entirely, using only electric light not only for the white light but also for the effects of colored light, we shall have eliminated entirely the danger of disastrous conflagration from our house. It will, however, be impossible to avoid entirely the use of canvas for scenery and the use of wood for the lighter and more temporary accessories of stage setting, and the large quantities of costumes and properties which accumulate about such a house are necessarily combustible. While a fire among these cannot be considered a menace to the structure, still there should be means at hand for readily extinguishing it. There is a choice, such as a system of automatic sprinklers, or the thorough training of the stage attendants in the use of water in tanks and pails, in the use of hand-pumps, hand-grenades, chemical fire-extinguishers, etc. But although the building is indestructible by fire, and although the gathering of headway by a fire is almost absolutely guarded against, alarms and frights may arise which, in so large an audience, would have serious consequences. A strong drop-curtain of indestructible material, used daily so as to be always in readiness for instant use in an emergency, will shut off from the view of the audience the accidental burning on the stage of small pieces of scenery, etc., as may have been left unprotected. A very large and high smoke-duct above the stage, the valve of which is connected with the prompter's stand, will permit the immediate and rapid escape of smoke produced by such fire, or by the use of fire-arms, etc., on the stage.

It is safe to assume that an audience in a house of this description is absolutely safe from fire; that is, that no combination of circumstances can arise by which any member of the audience can be injured in life and limb directly by the effects of the fire. There always exists, however, an element of danger in the liability in large assemblies to become panic-stricken and uncontrollable. The general solidity of construction and general safeguards against fire, mentioned before, will do much toward preventing the formation of a panic in the audience. Arrangements for averting the danger of the going out of all the lights in the house will eliminate another serious possibility of panic and danger.

The foregoing provides sufficiently for the safety, comfort and health of the audience; but all of these will be as naught unless the acoustic properties are such as to permit the easy and distinct transmission of articulated sound to its remotest parts. The suggestions given under the head of ventilation will be one of the means necessary for securing this end.

In addition to this, it should be said, in a general way, that in the construction of the banks of the seats, Scott Russell's isacoustic curve should be adhered to as far as practicable. That wherever possible resonant materials should be used in the construction and facing; that large, hard, smooth surfaces should be avoided; that walls and ceilings should be well broken; that the width and height of the house should be least at the stage, and that these dimensions should be increased with the distance from the stage, and that all our measures should tend toward the reduction to a minimum of the volume of air to be set in motion by the voices of speakers and singers, also to such arrangement of surfaces as will tend to direct the sound waves toward the audience, and such control of the air-currents as will prevent the dissipation of sound waves in space.

I will add in this connection that a comparatively low proscenium, and not exclusively wide-opening, is desirable as one of the first conditions of this system of construction for acoustic effect. If it is intended to use the house for conventions or concerts by mammoth choruses, the proscenium may be so constructed as to leave its width adjustable at pleasure, and a temporary ceiling may be suspended at or near the level of the crown of the proscenium-arch over the stage, and hung with a downward slant toward the back of the stage.

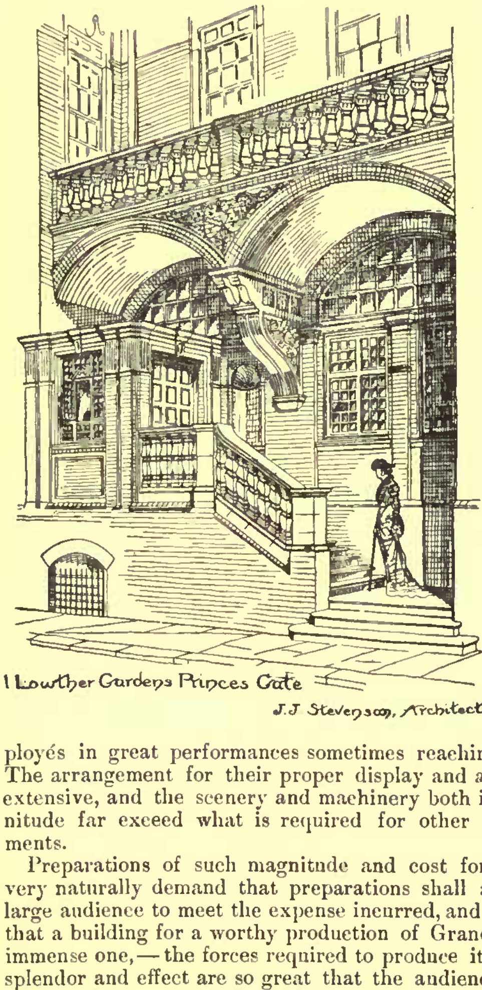
As I have said before, a modification of Scott Russell's isacoustic curve should be used in laying out the banking of the seats. This modification is for the purpose of obtaining an isaoptic line, and consists in shifting the level of the focus to which the curves are drawn from the level of a speaker's mouth to the floor-line at the front of the stage, and in substituting for a single focus to the middle of the stage, foci tending toward the sides of the curtain opening for the respective sides of the house so that the focus of the curve for the seats nearest any one side is at a corresponding jamb of the curtain opening.

It may not be always to follow the foregoing absolutely in the selection of foci for isacoustic and isaoptic lines, but the deviation should never be great, and the nearer the approach to these conditions the easier will be the sight-lines for all occupants of the house.

It will be found as one of the effects of an adherence to the foregoing that long, wide side galleries must be banished.

As Mr. Bloor has well said in his letter requesting this paper, "style is generally conceded to be a matter of taste, chiefly dependent upon education or temperament, environment or fashion, or on a combination of these; I have not included it under paramount requirements, but it is, nevertheless, the crowning element of an edifice in its relations with the contemporary public, and with posterity and history." And I will say upon this head only this, that the general proportions and materials of construction of such a building as this justify a general simplicity and demand the utmost dignity of treatment. This simplicity should, however, not become baldness, nor should the poetic element be excluded from the design.

THE ESSENTIAL FEATURES OF A LARGE OPERA HOUSE.[1]



We shall best understand the essential features of a large Opera House if we first consider, though very briefly, the purposes of the building.

These are threefold — musical, dramatic, and social. The first two are realized in the production of what is termed "Grand Opera;" works planned upon an extensive scale, requiring large forces both musical and dramatic, and extensive and elaborate scenery and machinery for the impressive effects desired. It will readily be seen that "Grand Opera" must be a very expensive affair; the number of artists and employés in great performances sometimes reaching several hundred. The arrangement for their proper display and action must be very extensive, and the scenery and machinery both in variety and magnitude far exceed what is required for other dramatic entertainments.

Preparations of such magnitude and cost for the performances very naturally demand that preparations shall also be made for a large audience to meet the expense incurred, and thus it comes about that a building for a worthy production of Grand Opera must be an immense one, — the forces required to produce it with any degree of splendor and effect are so great that the audience necessary to support these forces must be very large, and in consequence the building of unusual size and costliness.

But so costly are these performances that even the largest audiences will not meet the expense incurred, and other sources of revenue have always been indispensable.

On the Continent, Government aid has been freely given — both in building and supporting immense and famous Opera Houses. In this country, where the Government is not "paternal," aid has been found in another quarter: the wealthy, fashionable classes, who, even if not caring especially for, nor appreciating deeply the music, find it a peculiar and valuable social feature.

Its boxes afford a rare opportunity for the display of beauty and toilets.

They also give opportunity for the informal exchange of social courtesies, being open to select callers through the evening; the long waits between the acts especially favoring such interchange.

If at any time the box is not needed, the tender of it to friends is a very handsome compliment, and one that can sometimes be rendered where no other would be suitable.

For these and similar reasons the opera appeals strongly to the wealthy fashionables, who are able to give it the financial support that is indispensable, and so we find the third purpose of the Opera House — *the social one.*

The last feature is so important in a financial way that it naturally is the foundation of any enterprise of this kind, and in no small a degree determines the size and character of the house — the promoters of the enterprise will first decide how many persons can be secured to engage boxes at a cost of some $15,000 each, with assessments perhaps of $1,500 per annum. From fifty to seventy such must be found to raise a fund sufficiently large for a building; not a monumental building — but a capacious, tasteful and fireproof structure, suitable for Grand Opera.

The fifty, sixty or seventy box-holders must all be eligibly located — in not more than two tiers — which goes far to establish the size of the auditorium.

From the foregoing it will be seen that provision must be made in an Opera House for

1. A stage and its accessories on a grand scale.
2. For safely and comfortably seating a large general audience, and
3. For accommodating liberally and elegantly the box-holders who have built the house, guarantee it against loss, and receive their special accommodations as a return for the same.

The limits of this article will permit only a brief notice of the essential features of each of these divisions.

1. *Stage and Accessories.* — The stage must be deep, to give the perspective often necessary for fine effects, as well as to permit many scenes to be in readiness at needed points, it can hardly be satisfactory if less than eighty feet from the "tormentors" — or perhaps ninety-five feet from the footlights.

Its width will be governed not a little by the number of boxes and size of auditorium, but will probably be nearly a hundred feet.

It will have a deep cellar for disposing of scenery, as well as assisting in spectacular effects, and over the stage a rigging loft, etc., of great height for similar purposes, — spacious scene-rooms convenient to the stage will be indispensable for a considerable repertoire, as well as rooms for the varied branches that are allied to the Opera.

The rooms for the artists, musicians and employés will be simple, comfortable, well lighted and ventilated.

The orchestra will ordinarily be placed in front of the stage, as the leader needs to direct the forces on it as well as those immediately around him — but its pit should be sunk to such a degree that (with the exception of the leader) it does not intrude its writhing, restless members between the audience and the picture before them.

2. *The General Audience.* — The portions of the house devoted to it are the parquette and tiers above the boxes. They should be provided with spacious, comfortable seats (as opera performances are usually long), seats from twenty-two to twenty-four inches wide, and from thirty-seven to forty inches from back to back. The latter figure allows passage through the rows without great discomfort to sitters.

Spacious dimensions involve cost, but it must be remembered that Grand Opera is by no means an inexpensive affair.

The seating of the tiers probably cannot be as liberal from back to back, as it increases the difficulties of vision.

These difficulties require most careful study to make the naturally bad seats as good as possible; where they are decidedly bad it is better to remove them entirely, and use the space for standing room.

Another important provision for the audience is abundant and easy exits. If possible, these should be on three sides of the auditorium, so as to avoid crowding at a few points. Staircases should be built in towers, so that, were fires possible in any degree, they would protect from the noise, smoke, and element of panic. This leads to the further point — that of safety, and for this the building should be "fireproof," built almost entirely of masonry and iron, so that it should contain the least possible combustible material to feed a fire; it should be abundantly provided with water supply, and a very large iron tank at the most elevated part of the building (doubtless over the stage), to insure both the quantity and head needed.

The "automatic sprinkler," from which much has been expected when placed over the stage, has proved undesirable, as the pipes filled with water (to be in readiness to work automatically), are liable to freeze, and bursting, destroy the scenery underneath.

One more point should be touched upon in regard to the comfort of the audience — the ventilation. This must be done mainly by powerful machinery forcing large volumes of fresh and suitably-tempered air into all parts of the house. The products of gas combustion (if gas is used), should be drawn off, as far as possible, and not allowed to defile the air. In an ill-ventilated house the long performances toward the last are hardly endurable — and are invariably followed by headaches the ensuing day; surely, the late hours demanded by the performances are quite a sufficient tax for ordinary strength without the addition of blood-poisoning or fouling.

3. *The Accommodation of the "Box Holders" or Founders of the House.* — Each will have a box which gives a degree of seclusion while allowing a full display of the occupants. The boxes should command a good view, contain, without crowding, about six persons, and, to avoid disagreeable jealousies, be equally desirable in size, style, etc. Each box should have a small *salon*, or room opening out of it, to lay off or adjust wraps, etc., or to retire to if indisposed, or have a chat with friends, or partake of refreshments.

Broad corridors should connect all the several *salons* for easy access and interchange of visits.

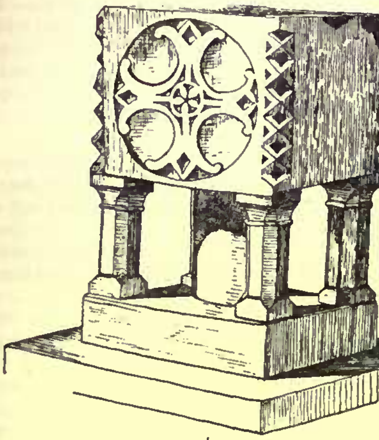
Large vestibules should be provided for those waiting for carriages — and covered driveways, that they may be reached without exposure.

A few words may be said upon the matter of style. After such a building as has been indicated has been planned, it will doubtless be found that there is little money left with which to make it "A Noble Work of Art," or "A Monumental Work." The great amount of solid masonry, the costly use of iron in unwonted forms and shapes,

[1] A paper was read by J. Cleaveland Cady, F.A.I.A., at the Twenty-first Annual Convention of the American Institute of Architects.

the large area of costly truss work, and the quantities of fireproofing, will rapidly consume the funds. Happy will it be if the architect acknowledges the situation frankly, and meets it in a simple manner; not doing some cheap and striking thing, or revelling in the latest architectural fashion which will shortly be despised; but following some honored and appropriate style, especially adapted to the economy he must exercise, treats the problem with a simple dignity that will not be tiresome or uninteresting as the years go by.

NICARAGUAN WOODS.[1]



Font, Twyford Church, Leicestershire.

THE woods of Nicaragua, grown under the sunny sky of the Torrid Zone, and in the mountains, valleys and on the sandy shores of the Atlantic and Pacific Oceans, are many in number and of widely different character in nature, strength and color. Unrestricted in their growth, in the exuberant and wild forests and woods of the country, they attain enormous sizes, and exhibit great strength and solidity. As a general rule, they are of delicate hues and beautiful colors, exhibit extreme fineness of grain and have marked peculiarities in texture and general appearance.

The investigation of their strength and natural properties is a matter of great interest. With the facilities offered in the Mechanical Laboratory of Sibley College for complete investigation of the materials of construction, I have thought it advisable to conduct such an investigation of a few of the Nicaraguan woods, so as to make known the characteristics, not only of those that have found their way into the markets of this country and of Europe, mainly because of their worth as dye-woods or for ornament, but also some others, perhaps of better, if not equally-prized properties, which have yet remained unknown in the industries.

In undertaking this investigation, I hope to find results which may prove of value and interest to the artisans of my native land, and also aid in developing, to a certain extent, the commerce and industries of Nicaragua, by making some of its natural products known in the United States and Europe.

I have restricted myself to the study of those woods which are most used in engineering construction and decoration, leaving out the dye and other woods, which, perhaps, may be of equal interest and value, there being quite as many unknown, or at least unused, valuable woods and plants of this latter kind.

I was encouraged from the start by Professor Thurston, who very kindly wrote to the Government of Nicaragua, asking for a collection of the most important woods of the country, expecting that its officials would take, or at least show, some interest, and thus secure a good collection of the woods. But, unfortunately, we were in this disappointed. It was by my father's interest, kindness and persistence, and through my friend Miguel Ugarte's active and courteous help, that I was supplied with as good a collection as could be obtained in the short time allowed to collect them. Steps were taken to get the woods, seasoned and sound, from persons engaged in working them, but they failed to obtain them. It is for this reason that the woods tested have not been entirely satisfactory, as they were cut green, and the men could not in most cases fell large trees to get the heart or the best of the wood; as a consequence, they checked on the way, and many of them were found to be knotty. The woods were collected in one month, within a circuit of three leagues, on the hills about Belen in the agricultural and chocolate-raising "Departmento" of Rivas, between Lake Nicaragua and the Pacific Ocean. Some few, obtained from a carpenter, are seasoned. My collection of fifty different varieties represents about half the number of the useful woods of the country.

GENERAL DESCRIPTION OF THE WOODS.

1. *Carbon.* — Extraordinarily solid, equalled only by the Piedra and the Quiebra-hacha. Is almost imperishable when used for posts, and is supposed to be very good for railroad ties. The tree attains a height of thirty feet, and measures twelve inches in diameter. Is common in most of the wooded districts. The wood is of a very fine grain, with peculiar dark streaks; very much like the mahogany in appearance and in color, but heavier and much handsomer. Is easy of working, and turns very smoothly.

2. *Cedro* (Cedar). — The wood, on account of its peculiar properties, has found a place in all the markets abroad. In Nicaragua it is found abundantly, and attains enormous sizes. Is used extensively for furniture, frames, book-cases, etc. It is even used by the Indians for boats, which they work out entire from the trunk of the tree.

3. *Chaperno.* — Dark red color, turns and planes very smoothly. It has a fine grain and great strength, and is susceptible of high polish. It is used extensively for cross-pieces of drawers and tables. Is extremely durable. There are two varieties of this wood, black and white, as they are called respectively. The tree attains a height of forty feet.

4. *Chiquirin.* — Dark yellowish wood, with a strong cedar smell. Is heavy, fine-grained, aud planes smoothly. The tree attains a height of thirty feet, and one foot in diameter. It has various uses, is durable, and having odor, is probably not subject to attacks by insects.

5. *Cortez.* — Extremely heavy and very fine-grained, of a very dark yellowish color. When broken in splinters, it gives off a fine yellow powder, which has similar properties to litmus; it turns bright red when mixed with soap water. It is a large tree like the Nacascolo. It is used in cabinet work, for framing, etc. The only place in which I can remember to have seen it growing is on a rocky hill at the foot of the volcano Mombacho, near the shore of Lake Nicaragua. The hill is covered with these trees, which, in the beginning of every spring, are a beautiful sight, being covered with yellow flowers.

6. *Granadillo-negro.* — Wood very much esteemed for interior decoration on account of its handsome dark color, fineness of grain, and ease of working. The tree attains a height of thirty feet, and is found on the shores of the rivers which flow into the eastern side of Lake Nicaragua.

7. *Gauchipilin.* — Fine-grained wood of a light-yellowish color, heavy and tough. The tree attains a height of thirty or forty feet, and has a diameter of fifteen inches. It is irregularly branched. Much used by the artisans for durable work, as it resists moisture for years. It is also used for telegraph-poles and railroad-ties. Is abundant all over the country.

8. *Guapinol.* — The tree is nearly as large as the Jenisero, and its branches large, but more erect. The wood is of a light mahogany color, long-grained, but very compact, heavy and tough. Is used almost exclusively for cylinders of sugar-cane mills, while the teeth moving them are made of guachipilin, guayacan or other similar wood.

9. *Guayabo de Monte.* — Attains a height of sixty feet, is of irregular diameter, and seldom over two feet above the lateral roots, acting as braces, which support the trunk. It has a fine grain and is very tenacious. The test made probably does not show full strength, as it was an inferior sample. It is used for small masts and the weather-streaks of boats. According to Mr. D. L. Murray, who preferred it above all others for launch-guards, it resists wear and tear better than any other wood.

10. *Guiliguiste.* — A wood unknown to commerce. Has a light-brown color in the heart, is fine and fibrous of grain. It ran above the average in compression. It is not as durable as the other hard woods, but from its beautiful grain and color, and from its ease of working, it would seem that it should be used for interior house-work. The tree is small, growing only about thirty feet high, with a diameter of fifteen to eighteen inches.

11. *Jenisero.* — One of the most useful trees, and one of the largest in the country. Attains a height of ninety feet, with seven in diameter, and its large branches cover a space of over one hundred feet in diameter. In Nagarote, a town in the Departmento de Leon, at the junction of one of its streets with the large road from the western departmentos, there is a jenisero whose branches cover a circumference of three hundred and forty-eight feet (about 9,498 feet area); it is ninety feet high, and has a circumference of twenty-one feet at four feet from the ground, according to Senor F. Guerreo Baster. The wood has a light to dark color and a peculiar grain; it is open and wide in the annual rings, but very compact between. It is used for cart-wheels, lasting for years without tires on clay soil. Used also by the carpenters in various ways. Its fruit is eaten by the cattle, and is used to sour the milk. It is fairly well distributed over the country.

12. *Jicaro-Sacaguacal.* — Attains a height of twenty feet, and a diameter from ten to twelve inches. Common on marshy land. It is of a nearly white color and very tough, used in saddlery and for boat-knees. Resists moisture and is durable in salt water. The shells of its fruits, after being worked, are used by the natives for drinking-vessels. They carve them very beautifully and artistically.

13. *Laurel.* — Dark color, light, strong and elastic wood and very easy of working. There are two varieties, male and female, as they are popularly called. Used mostly in frames for cots, and for work where elasticity is required. The dark kind is preferable. Both have a spicy smell. The tree attains a height of forty feet and a diameter from eight to twelve inches, seldom over eight.

14. *Lliguatil.* — This is one of the trees having many peculiar natural properties. Its fruits have a rich fragrance and flavor, and when green give out a coloring substance. From its bark a bluish and sometimes a purple substance is obtained, and from its sap thirty per cent sugar may be obtained; is one of the most elastic woods found in Nicaragua. It is used for drum-hoops, canes, etc. The tree seldom attains a height of twenty feet, and about twelve inches in diameter.

[1] Description by Rufus Flint, M. E., included in a paper by Prof. R. H. Thurston, read before the American Association for the Advancement of Science, and printed in the *Journal* of the Franklin Institute.

15. *Madera-Negra.* — One of the most useful trees found in Nicaragua, not only on account of its durability, strength and excellence for firewood, giving out intense heat, but also from its method of growth. It is about the only tree used to shade the chocolate trees. It has a rapid growth, and is easily produced from the seed. Mostly used for railway ties, posts for houses, fence-posts, foundations, etc. Has a dark yellowish color in the heart, is fine-grained, heavy and tough. It grows with oblong cavities, wasting a good deal of the wood when being dressed. However, straight logs one foot square and thirty feet high can be obtained.

16. *Madrono.* — There are two kinds, white and dark. It has a fine grain and is heavy. Its strength may be seen from the tests in torsion and by transverse stress. Its growth is irregular and branching.

17. *Mahogany.* — This is too well known to demand description. In Nicaragua it is fairly-well distributed. The best and most valuable is exported to a considerable extent from the Mosquito territory, where it grows abundantly, and to its fullest size. It is also found along the Pacific Coast in considerable quantities.

18. *Moran.* — Solid and fine-grained wood of a beautiful yellow color. After it has been turned it looks as if it had been polished; planes very easily. It is exported in great quantities as a dyewood. Is often used for columns. Attains a height of from thirty to thirty-five feet and a diameter of from twelve to eighteen inches.

19. *Nacascolo.* — The wood is extremely heavy, very fine-grained, and of a handsome dark color. Its toughness is shown by the test in torsion. The fruit is known by the names of *Nacascolo* or *Dividi*, and used for dyeing purposes when dry. It is one of the largest of hard-wood trees. Its trunk, although irregular in growth, and seldom over twenty feet to the point where it branches, is six feet in diameter. It attains a height of sixty feet, and is found more abundantly on the Atlantic Coast. Is an excellent wood for railroad ties.

20. *Nancite.* — Has a soft pink color, fine grain, and works very easily. The tree is small, grows on arid hills, and seldom attains thirty feet height. Its bark is used for tanning, and its fruits are to the Nicaraguenses what cherries are to the North Americans.

21. *Nispero.* — It may be said that there are two kinds, wild and cultivated. Large fruit tree of a thick and handsome foliage. The trunk is straight and free from limbs. The tree attains a height of sixty feet and a diameter of two feet. It is abundant all through the country in farms near the towns and in the wild forests. Exclusively used for wharves, bridges and posts. Resists moisture equal to any of the hard woods, and is said to petrify in the water. The wood is of an exceedingly fine grain, has a beautiful red color, and is very easy working. It behaved the best of any under compression, bulging out considerably before showing any sign of shearing or split.

22. *Oja-tostada.* — Has a very light pink color, is fine-grained and light. It is one of the most elastic and tough woods tested, as may be seen from the tests by transverse stress and by compression. It is very good for light and strong constructions.

23. *Palo de Arco.* — The sample tested planed easily in parts, and in parts less readily, probably on account of being green. Is hard, has a fine grain, and a light red color. It is used for construction where easy of access. It grows along the coast and in the coast range of mountains, attaining a height of thirty feet and fifteen inches in diameter.

24. *Piedra.* (Stone). — Has a fine grain, is heavy and strong, of a yellowish color in the sap and deep red in the heart. Turns very smoothly, and is one of the hardest and heaviest woods known, and yet not difficult to turn or plane. The tree attains a height of forty feet, and has a diameter of from fifteen to eighteen inches. It is imperishable. Used in many places for pillars and transverse beams of houses on farms distant from towns where it is easy of access. Is abundant on the hills along the coast on the Pacific slope. There are two varieties. It is an excellent wood, not only for interior decoration or for heavy furniture on account of its beautiful color and fineness of grain, but also for heavy constructions, as for foundations for engines or heavy machinery.

25. *Pochote.* — Tree of enormous dimensions. The wood is similar to the cedar, but much softer. It is used, however, in house-work for doors, walls, floors, shingles, etc.

26. *Quiebra-hacha* (axe-breaker). — There are two kinds, red and black. The latter, which was tested in three ways, is a most wonderfully tough wood. It has a color and appearance like the black-walnut, and its grain is similar to that of the oak. It planes beautifully smooth, and has a pleasing appearance on account of its dark streaks. The red kind, which grows very straight and spreads considerably, reaches a height of fifty feet, and from twelve to fifteen inches diameter. The dark kind, which spreads still more, seldom attains a height of forty feet. Their name, axe-breaker, indicates their toughness, for in cutting or felling them the axe is often broken. In cutting the samples received, two axes were nicked to the extent of one-half to three-fourths of an inch. The wood is durable and used for ties, poles, etc., and in posts for houses. One piece that had been for sixty-seven years in a clay soil was found still sound when sawed. The tree is common throughout the State.

27. *Quita-Calson.* — Its powder acts as a purgative. The tree attains a height of thirty to thirty-five feet, branching at fifteen or twenty feet from the trunk, and often has a diameter of two feet. It is abundant along the coast. It is used for boards where not exposed to the weather; it will not resist moisture.

28. *Roble.* — Light-colored wood of a curly and beautiful grain. It is pink in color and used in house-building. The tree has exceedingly large leaves, fourteen inches long and about seven inches wide, is often fifty feet high, and from twelve to fifteen inches diameter. Is abundant along the coast.

29. *Ron-ron.* — This is one of the largest of hard-wood trees growing on the shores of the rivers of the Departmento of Chrontales on the Atlantic slope. It reaches a height of fifty or sixty feet, and often a diameter of three feet. Dark, fine-grained wood, strong, heavy and durable. Is used in cabinet work, turns very easily, and is susceptible of polish. It turns dark with age.

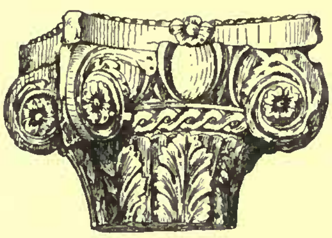
30. *Tempisque.* — This tree is of historical interest in Nicaragua, and is one of the largest found in the tropical forests. It attains a height of seventy-five feet or more. The trunk is irregular and seldom reaches twenty feet to the beginning of the largest branches. It has a diameter of six feet. The wood is fine-grained, hard, and very excellent for desks and other articles of cabinet-work. Like the mahogany it turns dark in a few years, and is equally durable. The cattle eat its fruit.

31. *Tiguilote.* — Light wood, grows about thirty feet high, and over twelve inches in diameter; good wood for carriages. It is used for fence-posts; it easily roots when set with care, thus making a permanent fence and a pretty grove.

32. *Zapotillo.* — Of a light mahogany color, has a fine grain, and is light. Attains a height of forty feet and one foot in diameter. It is not very much used.

33. *Zopilote* (Buzzard). — Coarse, long-grained wood, but of compact layers when viewed in cross-section. It has a greenish color. Turns and planes fairly well. The wood is used only in neighborhoods where more useful woods are scarce. When unexposed or when well seasoned and protected with paint, it would probably be a valuable wood, as it ran above the average in torsion, was among the highest in compression, and stood well under transverse stress. It attains a height of about forty feet and one foot in diameter.

THE ENGINEERING FEATURE OF THE NICARAGUA SHIP CANAL.[1]



A Roman Fragment. — the Museum at Dijon

THE Nicaragua Canal is known by name, probably, to a majority of persons in this country; but the revised route, the enlarged capacity and the new features presented as the result of the last survey, made two years ago by the United States Government expedition in charge of Civil Engineer Menocal, U. S. N., are not so well known, and of them I will speak. The distance from ocean to ocean by the proposed route is 169.8 miles. Of this distance, however, only 40.3 miles are actual canal, the other 129.5 miles being free navigation through Lake Nicaragua, the Rio San Juan and the valley of the San Francisco. Beginning at the port of Brito on the Pacific side, the canal ascends the valley of the Rio Grande by four locks, and cutting through the low divide enters Lake Nicaragua 17.27 miles from Brito, at an elevation of 110 feet above the sea. The route then extends across the lake, which is 40 miles wide and over 90 miles long, to its outlet into the Rio San Juan, a distance of 56½ miles. Then down the broad, deep reaches of the majestic San Juan to the dam, 64 miles from the lake. This dam, 1,255 feet long and 52 feet high, backs the water of the river the entire distance to the lake, and makes it simply an extension of the lake. On the north bank of the river just above the dam, a short section of canal, less than two miles long, cuts through the hills into the Y-shaped valley of the Rio San Francisco lying north of the San Juan and separated from it by a range of hills. An embankment, 6,500 feet long and 51 feet high in the centre, built across the stem of the Y, floods this valley to the level of the water above the dam, and makes about ten miles of lake navigation. At the eastern end of this lake commences the eastern division of this canal, and pierces the divide by a cut 14,200 feet long, and averaging 149 feet in depth. At the eastern end of this cut is the upper lock of the Atlantic flight, and from here the canal descends the valley of the Deseado by three locks to the sea level, and stretches across the lagoon region back of Greytown to the harbor, 11½ miles distant. From the last lock to Greytown, the same as at Brito on the west side, the canal is enlarged, forming an extension of the harbor 11½ miles inland. The lake and the river must form a part of any and every canal route through Nicaragua, and the location as a whole is the result of Civil Engineer Menocal's complete and exhaustive personal knowledge of the entire country from ocean to ocean, gained in the course of eight different surveys, extending over a period of fifteen years, and supplemented by a conscientious study of all that has been done by others in that region.

Of the 40.3 miles of actual canal, about 27 miles will be excavation pure and simple, while the remaining 13 miles will be largely, if not entirely, excavated by dredges. With the convenient dumping-ground for earth excavated, with a large portion of the rock from the

[1] Abstract of paper read before the American Association for the Advancement of Science, at the New York meeting, by Civil Engineer R. E. Peary, U. S. N.

summit cut utilized close at hand in the construction of the locks, the dam across the Rio Grande, and in pitching the slopes of the canal, and a still larger quantity to be consumed in the construction of the breakwaters at Brito, the work in this section admits of the most economical execution. The divide-cut from the basin of the San Francisco to the upper lock, 14,200 feet in length, and with an average depth of 149 feet, is, it is admitted, a very serious job; but with the neighboring streams offering water at a high head for removing the surface-earth by hydraulic mining, with a large plant of power-drills worked by compressed air, from the same source, and the use of modern explosives to remove the rock, with a large proportion of the excavated rock to be used in the construction of the locks and the dam, and in pitching the slopes of the canal, and a still larger quantity utilized in the construction of the harbors at Greytown; with the laborers above the miasma and mosquitoes of the swamp and exposed to the pure breath of the trade winds, the work can be done without serious difficulty.

There are two features of this project which, to many who have not made such structures a study, cause a question of safety to arise; one is the dam, which at one stroke gives us 64 miles of river navigation, and the other is the embankment, which, at a second stroke gives us over eight miles of lake navigation, and completely solves for that portion of the canal from the dam to the divide (13 miles) the important problem of protection from surface drainage; but neither of them are anything more than small affairs when compared with many others scattered about the world, and serving much less important purposes than the ones under consideration, and beside the Quaker Bridge Dam they are pigmies. Right here at the Croton reservoir is a dam which is to-day standing twice the strain that either of them will ever be called upon to resist. The locks are to be magnificent structures of concrete, 850 feet long, 80 feet wide and 30 feet deep, capable of containing any merchant vessel afloat, except the *Great Eastern* and possibly the *City of Rome*. The necessary machinery for moving the locks and culvert gates, for hauling the ships in and out of the locks, for electric lights and other purposes will be worked by hydraulic power furnished by the locks themselves.

In regard to the general question of locks, the late Ashbel Welch and the late John G. Stevens are quoted at some length in favor of their use.

Much has been said about the harbors at the termini of the Nicaragua route, and neither time nor space will permit me to enter into the discussion here. It may be said, however, that there is no practical route for a canal across the American Isthmus that has good harbors, and it is believed that those at the termini of the Nicaragua Canal can be made first-class at less cost than those of any other route. There is nothing more difficult in the improvement of Brito Harbor than has been successfully accomplished at numerous French and English breakwater-protected ports and harbors, and the maintenance of the harbor of Greytown will be a much less serious job than is the maintenance of the Port Said entrance of Suez, with the enormous salt discharge of the Nile driven across its mouth by strong littoral currents.

Lake Nicaragua has a surface area of some 2,000 square miles, and a drainage area of not less than 8,000 square miles, and the Rio San Juan, its only outlet, discharges at its lowest stage, near the close of the dry season, eight times the maximum supply required by the locks. An inexhaustible supply of the best building material, such as lime, natural cement, stone and timber, can be obtained on the line of the canal, and with an abundance of palm leaves for thatching such temporary buildings as are required for the accommodation of the working force and the protection of property can be constructed at little more expense than that of handling the material.

At Suez the traffic has been seriously delayed by the dimensions of the canal and the inadequate number of the turnouts. In the present project not only have enlarged prisms been provided for, but larger basins are proposed at the extremities of the locks. These basins, the enlargement of the canal at each end, with the lake, the river and the San Francisco Basin, will permit vessels to pass each other without delay at almost every point on the route. In 22.37 miles, or 57 per cent of the canal in excavation, the prism is large enough for vessels in transit to pass each other, and of a sectional area in excess of the maximum area in the Suez Canal; the remaining distance in which large vessels cannot conveniently pass each other is so divided that the longest is only 3.67 miles in length; that, with two exceptions, those short reaches of narrow canal are situated between the locks, and can be traversed by any vessel in less time than is estimated for the passage of a lock; consequently, unless a double system of locks be constructed, nothing will be gained by an enlargement of the prisms. In the lake and in the largest portion of the San Juan River vessels can travel almost as fast as at sea. In some sections of the river, and possibly in the basin of the San Francisco, although the channel is at all points deep and of considerable width, the speed may be somewhat checked by reason of the curves.

ESTIMATED TIME OF THROUGH TRANSIT BY STEAMER.

	H.	M.
38.98 miles of canal, at 5 miles an hour....................	7	48
8.51 miles in the San Francisco basin, 7 miles an hour.......	1	14
64.54 miles in the San J an River, at 8 miles an hour.........	8	4
56.50 miles in the lake, at 10 miles an . our.....................	5	39
Time allowed for passing seven locks, at 45 minutes each. ...	5	15
Allow for detention in narrow cuts, etc.........................	2	00
Total time...........................	30	00

The experience of the Suez Canal shows that the actual time of transit is more likely to fall under than to exceed the above estimate. The traffic of the canal is limited by the time required to pass a lock, and on the basis of forty-five minutes (above estimated) and allowing but one vessel to each lockage, the number of vessels that can pass through the canal in one day will be 32, or, in one year, 11,680; which, at the average net tonnage of vessels passing the Suez Canal, will give an annual traffic of 20,440,000 tons. This is on the basis that the navigation will not be stopped during the night. The estimate of the total cost of the canal is $64,043,699, which sum includes 25 per cent for surveys, hospitals, etc., and contingencies. The completion of the canal will require six years, one for final location and five for active work of construction, and the probable traffic for 1892, the possible date of completion of the Nicaragua Canal, is 6,506,214 tons.

COMMUNICATIONS

THEATRE PROTECTION.

Boston, Mass., October 24, 1887.

To the Editors of the American Architect: —

Dear Sirs, — I happened to be in Europe at the time of the burning of the Theatre Comique, in Paris, immediately after which I was asked to explain the working of automatic sprinklers, with a view to their adoption in theatres. A little later the terrible disaster happened at Exeter, presenting a case in which certain safeguards, which are a common rule in factories, might have prevented the terrible loss of life.

The question of immediate importance seems to me this: *How can existing theatres, which cannot be reconstructed, be made safer than they are?*

Referring to the minute account of the disaster at Exeter, you will observe that immediately after the fire took place and before the people in the gallery had even begun to make their escape, the curtain bulged outward toward the auditorium, and the flame and smoke, passing by the curtain at the side, filled the upper part of the auditorium and suffocated large numbers of persons in the gallery.

These conditions indicate the lack of one of the safeguards formerly wanting in factories and warehouses, but now in almost universal use, especially over the elevator-shafts; to wit, a window in the roof glazed with the thinnest kind of glass, with a view to its being broken at the very first contact of the heated air from the fire below, even before the fire has reached the upper story, so that the elevator-shaft may serve as a flue to draw sparks, flame and smoke coming up from the basement, *away from the upper rooms;* without this provision the ordinary tight roof turns the heat and flame inward, and spreads the conflagration through the upper story.

Would it not follow that every theatre should be furnished with a large skylight, or it might even be a very large open ventilator inside the arch which is between the stage and the auditorium and directly over the front of the stage? The glass being broken by the heat, this would give an outlet to the smoke and flame of the burning stage, and would draw fresh air *into* the auditorium from the open doorways.

It would be possible to construct a large trap door, held in its place by fusible solder, which will resist a pressure of 500 lbs. to 1,000 lbs. per square inch, but will yield at a heat of 160° Fahrenheit.

Is it not true that however ample and adequate the stairways may be, an accident like that which occurred at Exeter — namely, the upsetting of the ticket-taker's table and box — will trip some of the audience up, cause a temporary block, and thus create a danger under any circumstances and conditions?

An iron curtain is much relied upon. According to our experience, while it might possibly remain unwarped long enough to permit an audience to escape, even that is doubtful. The heat from the contents of a burning stage is very sharp and sudden and would be more liable to twist and warp the iron curtain *before* the audience has escaped, than to hold the flame until they had gone out.

From our recent experience with the automatic sprinkler properly arranged, all who are conversant with factory risks would have little doubt that almost any stage could be made safe; that is to say, by the action of the sprinklers the fire could be held long enough to permit an audience to escape from any theatre of those which are least adequately furnished with stairways. Experience with this apparatus now covers so many cases of dangerous fires, stopped with little or no loss, as to give increased confidence in the security afforded by it.

In my judgment, the adoption of an automatic sprinkling system ought to be made a condition of the license and a part of the Police Regulations for every theatre, however constructed, no matter how ample the exits may be. Edward Atkinson.

SOLID TIMBER FLOORS.

New York, October 24, 1887.

To the Editors of the American Architect: —

Dear Sirs, — Anent the Holbrook Hall floor failure, Mr. R. G. Hatfield, in the 1877 issue of "*Transverse Strains*" gives formulæ in Article 702 for the elements of solid timber floors.

It might be interesting to know whether any one else has had experience with solid timber floors for resisting fires because of the early failure of light iron beams, due to rust, and the consequent expense added for heavier construction. Is it impossible to so construct a solid timber floor as to obviate dry rot?

Yours respectfully, Geo. Martin Huss.

NOTES AND CLIPPINGS

Blowing-up Chimneys.—An interesting scene was caused recently by the blowing-up of the two immense chimneys on Borsig's Machine Works in Berlin. A large number of spectators were present to witness the ceremony, including several officers of the army, the trustees of the Borsig estates, and the employés of the works. Punctually at five minutes past six, p. m., the signal to "Look out!" was given; then came the word of command "Fire!" and at this moment the vast chimney, towering to a height of say 120 feet 9 inches, quietly collapsed. The noise occasioned by the fall was not very great, ditches two metres in breadth having been dug all round the chimney and filled with straw. For blowing up this colossus, which consisted of 98,000 bricks and was topped with a heavy iron cap weighing twenty-five centners, only 24 kilos of dynamite were employed. Photographs were taken of the chimney before it fell, and also as it was in the act of falling, by an officer of the Commission for Experimenting with Explosives. The second chimney, standing about 80 feet high, was blasted with gun-cotton, of which 35 kilos were required.

Bamboo Tree.—Writing from China, a correspondent says that the Chinese have developed the culture of the bamboo tree very wonderfully. They can produce a perfectly black as well as a yellow bamboo. The emperor of China has one officer whose duty is to look after his bamboo gardens. This valuable tree is found in all tropical and subtropical regions, both in the eastern and western hemispheres. An attempt has been made in England, and with some success, to raise a dwarf species found at an altitude of 12,000 feet in the Himalaya mountains. The new world furnishes bamboo of the greatest diameter. The stems are usually very slender, but in the northwestern part of South America is found one species with a diameter of 16 inches. The Chinese put this plant to a greater variety of uses than any other people. Some kinds of it when it first shoots up from the ground are used as a vegetable as we use asparagus, or it can be pickled in vinegar or made into delicious sweetmeats. The plant has to be 30 years old to blossom, and then it bears a great profusion of seeds and dyes. These seeds may be used like rice, and a kind of beer may be made from them. In 1812 severe famine in portions of China was prevented by the sudden blossoming of a great number of bamboo trees. The stems of all the varieties are remarkably salicious. One kind found in Java is so hard that it strikes fire when the hatchet is applied to it. This has only a very slender stem, which is polished and used as stems for tobacco pipes. This protean tree furnishes material for houses, boats, cordage, sails of boats, telescopes, aqueduct pipes, water-proof thatching, clothing, water-wheels, fences, chairs, tables, bookcases, boxes, hats, umbrellas, shields, spears, and paper. The pith is used for lamp-wicks, so there is no part of it that can not be used for something. From some of it exquisite carvings inlaid with gold and silver are cut, that exceed in beauty the ivory carvings for which the Chinese are so famed. Recently it has been put to another use. Mr. Edison has found that the carbonized fibres of the bamboo furnish the best material for the incandescent electric lamp and has made use of it in his system of lighting. In Burmah and Siam whole cities are built from bamboo. These houses are made in pieces, lashed together, and raised on posts several feet high.—*The Lumber World.*

Hardening Plaster-of-Paris.—The following information on this subject, supplied by a correspondent of the *English Mechanic*, may prove of interest: Among the methods of hardening or toughening plaster-of-Paris those recommended most frequently are the use of alum in the water, or a decoction of marsh mallow. Some, however, use gum or glue; but in every case the plaster takes longer to set, and it will probably be found that the addition of a little sulphuric acid to the mixing water is all that is necessary. If a strong stucco is required, the plaster should be made into a *magma* with a solution of glue, which should not be concentrated. The mass requires a longer time to set than when pure water is used for mixing; but the mass becomes harder in the end. If the cast is to remain white, colorless glue or gelatine must be used. Regarding borax, various authorities differ in the proportions and method of its use. Thus one writer says that the crude pieces of burned gypsum should be saturated with a solution of borax, again burned for six hours, and then ground. A still better effect is said to be obtained with borated gypsum by taking the *magma* for casting with the aid of a cold saturated solution of cream-of-tartar. Michaelis criticises the proportions of borax and cream-of-tartar quoted by others, inasmuch as they are directed in larger quantity than cold water would dissolve; while, on the other hand, gypsum should not be made into a *magma* with a hot solution. He therefore believes that if these additions are really useful cold saturated solutions would be all-sufficient. If burned gypsum in lumps is placed in a saturated solution of alum, afterward dried in the air, and again burned at as low a heat as possible, the resulting powder, particularly if mixed to a *magma* with a solution of alum, will yield very hard casts. The same result can probably be obtained by intimately mixing finely-powdered plaster-of-Paris with about two per cent of burned alum, likewise in very fine powder, and making the *magma* with water. The addition to the water of a little solution of silicate of soda (not prepared from the thick or gelatinous variety, but from the clear, syrupy solution), will probably aid the setting. When a cast has been made, the best way to harden it is to warm the cast to about 170° Fahrenheit, and then to quickly brush it over with a glass brush dipped in a hot saturated solution of caustic baryta, which must be carefully kept from the air until it is to be applied. The bartya will sink into the pores of the external layer of the cast, absorb carbonic acid from the air, and form carbonate of barium, which increases the density and hardness. A mixture of plaster-of-Paris with powdered anhydrous borax would perhaps answer the purpose likewise. Possibly by taking a dilute solution of shellac and borax in water for making the *magma* a satisfactory result may also be obtained.

TRADE SURVEYS

The rule by which speculators determine the degree of prosperity throughout the country is not the rule which producing interests can safely adopt. For months past speculation of every kind has come to grief, while legitimate industry has been prospering. It seems as though the conditions arrived at render pure speculation almost an impossibility. Corners of every kind have failed. The only hope for success is in the scarcity of money. The action of the Government in buying bonds is everywhere regarded as a wise thing to do in order to protect business interests. There is another view of this question. If there is not enough money in circulation to supply absolute requirements of business, a system should be established which would supply enough. This is the commonsense view of the matter. A financial stringency will always hover around the financial world until a wise and comprehensive system is devised and established. Speculators and banking interests, as well as individual money-lenders, may be satisfied with the existing arrangements, because it offers them more frequent opportunities of lending money at exceptionally high rates of interest. The business and industrial interests of the country demand the lowest possible rate and a regularity which our existing system cannot guarantee. This fact is acknowledged by the most careful thinkers, but no remedy has, as yet, been suggested, which will secure a uniform or elastic volume of currency. Supply and demand ordinarily regulate themselves. Money is an exception. It is largely a matter of legislation. The exigencies which created our existing system have passed, but the fruits of that system still remain, and the rapidly-expanding industrial interests are obliged to conform to the monetary system in which they find themselves. Our leading financial authorities intimate that this is one of the coming issues, but prefer to defer a discussion of that issue until it cannot be any longer avoided. Opposing theories differ as to the wiser policy concerning the monetary system. Some demanding a gold basis, others a mixed gold and silver basis, and others an exclusive or partial paper basis, but meanwhile the country is expanding in railroad construction, in business of all kinds, and in population, and its necessities for more money are of such a character that the demand cannot be quietly ignored. The Government may buy in its ten or twenty millions of bonds with greater or less frequency, but this is only prolonging a dangerous policy. The expansion of the currency, within the past fifteen months, has been over $100,000,000, and but for this, say the advocates of increasing volume of money, a panic would have occurred. Those whose opinions are based upon an exclusive gold basis, or gold and silver basis, want to say that the country would have been even better off had that basis been adopted. Everything points to the greater necessity for an international monetary understanding, but while Great Britain stands isolated in its opposition, it is an impossibility to agree upon a basis which will be accepted by all of those whose consent is necessary. This long debated question will never receive a solution until circumstances compel it, and nothing but a radical change in the economic and commercial conditions and relations of two or three of the leading powers will bring about a change. While Great Britain holds commercial supremacy on the seas, it is not to be expected it will agree to accept a position that that Government has heretofore strenuously opposed. The continental idea of a monetary basis would become a generally adopted one but for the opposition or indifference of Great Britain. In the United States a lack of understanding of this vital question is now causing more or less indifference. Reference is made to this much-talked-of question simply because it is a question which will soon force itself into prominence. The business and manufacturing requirements of this country are two features, or rather one, which will necessitate the establishment of an international basis. Our export interests are steadily growing. In a short time our commercial relations with foreign countries will be more intimate. A tariff agitation in the United States is in sight. A reduction of duties upon many now-taxed articles is probable. The farmers of the West are taking stronger ground in favor of lower duties than they ever have done. Even manufacturers of the East are disposed to recognize that in some particulars at least a modification of our tariff system would be beneficial. This tariff, or modification of duties, is intimately connected with a better monetary international system. There is no doubt but numerous interests would be hurt at the outset, but it must be admitted that advantages would accrue from another revision of tariff duties. The country is in a transition state from high to lower duties. The great question is now, how to adjust these duties so as to develop our export trade without injuring our domestic trade or industries. All of the industries throughout the country continue in a most active condition, and it might, perhaps, be better to let well enough alone rather than to introduce disquieting agitations and jeopardize development, which is now progressing so satisfactorily. The farming and cotton-growing interests of the country are prosperous, and a great addition will be made to the agricultural area next year. Manufacturing and agricultural interests have kept themselves quite evenly balanced during the past twelve or twenty-four months. Our development is leading us into unexplored fields, and our prosperity is a constant surprise. Policies and measures seem to suggest themselves rather than to be suggested. No dangerous issues are before us. The money question and all other questions will, after all, settle themselves. It will be simply a matter of dollars and cents rather than of politics when this and all other questions come up for decision. The decentralization of industries, which has been going on in the South and West within the past few years, has changed the condition of our industrial development, and made things possible which were a few years ago impossible. It is not at all probable that railroad building will fall off as so many are predicting. It is probable that our export trade will readily expand, that manufacturing enterprises will multiply, that house and shop building will continue at the rate of the past two or three years, and that the supply of money will be equal to the demands. It is, therefore, useless to borrow trouble or to endeavor to foresee disaster. At the same time, it is possible and probable that this extraordinary activity will rush into overproduction within two years, and a necessary reaction then set in. Meanwhile, industries will increase, prices will remain firm, production will be continuous, and the growth of wealth will help to stimulate a multitude of enterprises in all of the newer sections of the country.



BALMORAL CASTLE, SCOTLAND.

HELIOTYPE PRINTING CO BOSTON

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THE profession of architecture has lost a true friend in the death of Alexander James B. Beresford-Hope, which occurred late last month. Mr. Beresford-Hope was the son of Thomas Hope, a member of the great and ancient commercial house of Hope & Company, of London and Amsterdam, whose Amsterdam house, under the old name, still overlooks the calm water of the Prinsen Gracht. The elder Hope, as well as a very rich man, was a devoted amateur of what might be called applied fine art. He fitted up his London house with furniture entirely designed by himself, and filled it with a collection of pictures and statues which has become famous. Soon after this house was completed, he published a description of it, with illustrations, under the name of "Household Furniture and Decoration," which produced a sensation in its day comparable to that which followed the publication of Eastlake's "Hints on Household Taste" in our own time. After this, he interested himself in architecture and archæology, and published a book on mediæval architecture, illustrated by himself, besides the well-known "Costumes of the Ancients," which has become one of the classics of archæology. Although he died when his son Alexander was but ten years old, the latter inherited his father's passion for art, and particularly for architecture. While quite a young man, he bought a ruined abbey and refitted it as a training-school for missionaries, and published several books on church architecture. His treatment of this subject won him recognition among architects as an expert, second in attainments and ability to few in the profession, and, in return, he took great pleasure in attending the meetings of professional bodies, and taking part in their discussions, and was elected one of the earliest presidents of the Royal Institute of British Architects. Although a very busy man, being for thirty years a member of Parliament, as well as the proprietor and manager of the London *Saturday Review*, and the author of a great number of magazine and review articles, besides various novels and other books, he almost always found time to attend the Institute meetings, and took part in its affairs with a sincere but modest interest. During the past year his failing health had compelled him to give up his active participation in professional matters, to the great regret of his fellow-members, who watched the progress of his infirmity with solicitude, and will deeply mourn his death. Although not extremely conspicuous in politics, Mr. Beresford-Hope was at one time a member of the Queen's Privy Council, and was indirectly connected very closely with the Government through his marriage, which took place immediately on his graduation from college, with Lady Mildred Cecil, the sister of the present Marquis of Salisbury, the real ruler of the British Empire.

AN outrageous case of conspiracy by labor-autocrats against other people's business has been discovered in New York, and the conspirators are on the way to what we hope will be exemplary punishment. Not long ago, as we learn from the daily papers, Messrs. Merritt and Company began the construction of sixty-one houses, occupying several contiguous blocks on Seventh Avenue, about Seventy-fifth Street. The firm made a contract for plumbing some of the buildings with a plumber named Austin. Everything went on well until Mr. Austin got into some sort of dispute with the Plumbers' Union; whether on account of employing inadvertently a non-Union man, or for some other cause, we are not informed. The Plumbers' Union, finding Mr. Austin indisposed to obey its commands, seized upon Messrs. Merritt and Company as cats-paws to beat Austin with, and, although they were on good terms with all their men, threatened them with vengeance unless they undertook to coerce Austin. They declined, and the Plumbers' Union applied to the Central Labor Union, which declared war on Merritt and Company. As the latter succeeded in getting men who were not subjects of the Union to work for them, the Board of Walking Delegates betook themselves to the dealers in materials, to try to deprive their victims of the means for carrying on their buildings. Hearing that Merritt and Company had bought a cargo of brick from a certain dealer, and that the vessel was lying at the pier, they applied to the Boatmen's Union, who immediately moved the vessel out into the stream, and threatened the captain with violence if he dared to unload any of the cargo. Not content with this, the walking delegates went to all the principal dealers in materials, and threatened them with boycotting and the ruin of their business, if they sold any goods to Merritt and Company. Most of them submitted at once, and notified the unfortunate firm by letter that they could sell them no more materials. One, however, had the courage to remonstrate, saying that he did not think it fair to make such a demand. The reply was that the Board of Delegates would stop his business; and three days later all the drivers and truckmen in his employ left their work, informing him that they had been ordered to do so by their Unions. As he had kept a hundred and sixty horses, with their drivers, constantly busy hauling building materials, the strike of his teamsters put a complete end to his operations, involving him in great losses, simply because he had been a little slow in clubbing another innocent man, who had neglected to club a third man, against whom the walking delegates had a grudge. Meanwhile, the Messrs. Merritt, deprived of supplies, were compelled to stop work on their buildings, at an immense cost for deterioration and loss of interest on the money which had already been invested in them, and in the land on which they stood. Taking this investment at a million dollars, which is probably far below the truth, the interest charge alone would be about two hundred dollars a day, yet the judge of the court into which the conspiring delegates were, after some trouble, brought, coolly admitted them to bail in seven hundred dollars each, and postponed their examination for nearly three weeks, at the request of their counsel, who asked that his clients might not be disturbed about the matter "till after election."

THE *Iron Age* quotes from the records of the Texas Supreme Court a recent decision of much interest to contractors, and, we imagine, to lawyers. A builder estimated upon an addition to a house, offering to build the addition for eight hundred and fifty dollars, according to the plans and specifications furnished by the owner's architect. His bid was accepted in due form, and he commenced the work. When it was nearly finished, but before he had been paid, the house was burned. No time had been fixed for the payment of the contract price, or of any part of it, but immediately after the fire he demanded payment of the full amount. The owner resisted, on the ground that he had not received the building which the contractor had agreed to furnish complete, adding that the builder, instead of trying to indemnify himself out of the owner's pocket for the destruction of his work before it was delivered, ought, if he did not wish to bear the risk alone, to have insured his interest in the usual way. The lower Court, however, refused to hear evidence on this point, and ordered judgment for the plaintiff, and the Supreme Court sustained the decision, saying that "if a builder be willing to trust to the solvency of the person for whom he does work and furnishes

material, the latter has no right to thrust upon him the burden of insuring the property on which he does work." With all respect for the Supreme Court of Texas, this seems to us very queer law. A builder, who is sure of his lien upon the structure which he erects, as well as the land on which it stands, to the exclusion of all other creditors, need not usually trouble himself about the solvency of the other party to the contract; and in any case we cannot see the connection between this question and that of the duty of the proprietor to a risk which is not his, and which he cannot even estimate intelligently. The managers of insurance companies in Texas may be more amiable than they are in other places, but those which we have dealt with have always claimed that until the owner had paid, at least in part, for a building under contract, he had no insurable interest in it, and could collect nothing, in case of loss, no matter how many policies he had taken out. He might possibly, it is true, take out a policy payable to the builder, but in this case, on the Texas theory, he would still be bound to pay the contract price for the building destroyed, while the builder could collect the indemnity, and do as he liked with it.

THE second part of the Supreme Court's opinion was about as remarkable as the first. Leaving the particular case in hand, and ascending to generalities, the judge remarked that "Some courts have decided that when the contract is for an entire piece of work nothing is due to the workman until the contract is fully completed, but we are not disposed to follow these courts. We think that even when a workman abandons a contract he should be paid for what he has furnished and done at a price to be fixed by the value of the material and work and labor, not, however, in excess of the contract price." We shall not undertake to enter here into the question of entire contracts, preferring to leave that to lawyers, but we are disposed to think that the authority of "some courts" in regard to the matter is so highly esteemed in other places that it would be a hazardous experiment for a contractor in any State but Texas to abandon a contract wilfully before completion and try to collect payment in full for what he had done.

ONE of the new building materials which is likely to be found useful in many ways is common salt. Among the carpenters salt is now found to be useful as an aid to the heating of glue. Where, as is usual in joiners' and cabinet-makers' shops, the glue is melted in a jacket-kettle, surrounded by water, it is said to be advisable to put salt in the water in the outer kettle. The addition of salt raises the boiling point, and therefore allows the glue in the kettle to be kept at a higher temperature than could be maintained with water alone, and this is advantageous to the work. The masons find their use for salt in adding it to cement-mortar in cold weather, to preserve it from the bad effects of freezing. It is not quite clear why the salt should act in this way, as the beneficial results of using it are visible with mortar which has certainly been frozen, and frozen salt water expands nearly as much as fresh water; but engineers and contractors who have tried it are unanimous in their opinion of its value. In many cases masonry has been laid in cement in cold weather, using a considerable proportion of salt in the mixture, which, after repeated freezings and thawings, has remained in perfect condition, while work near by laid in mortar of the same kind, but without salt, has been disintegrated by the frost.

A REMARKABLE description of the effects produced in the African desert by the sinking of artesian wells is given in *Le Génie Civil.* Every one remembers that in the southern part of Algeria and Tunis, nearly parallel with the coast, stretches a chain of valleys, or rather, of flat low-lands. many portions of which are below the level of the Mediterranean. A few years ago, the late Captain Roudaire earnestly advocated the cutting of a canal to connect these depressions with the Mediterranean, with the idea that the shores of the salt lakes so formed would be rendered fertile. In the course of the investigations made by the French Government to ascertain the feasibility of the scheme, several artesian wells were sunk for a temporary purpose, which yielded such an abundant supply of water that later comers were induced to bore similar ones for permanent use. All these flowed so freely that by degrees the scheme for forming an inland sea was forgotten, and well-sinking was begun on rather a large scale, with the effect of changing the whole aspect of the place, which now, from a waste of sand, continually encroaching on the few oases, has become a thriving region dotted with orchards and gardens, and increasing daily in wealth and population. The investigations of the French engineers who have wrought this change have shown, that theirs are not only by no means the first artesian wells sunk in the desert, but that long before the people of Artois had thought of boring the deep wells known by their name, the Arabs of the desert had sunk them with perfect success.

ACCORDING to the native tradition, the wells which maintained the fertility of the ancient oases, and some of which still remain, were first drilled by a supernatural being with two horns, who reigned over the country in prehistoric times. This hero, after endowing his country with prosperity and abundance by means of his magical invention, disappeared, leaving the secret of his processes to a few disciples, who have handed it down to the present day, although for many years no one has attempted to put them in practice. The valley consists geologically of a basin of stratified rock, filled in with sand and alluvium, or rather, perhaps, with wind-blown dust. The strata of the underlying rock are turned upward on the sides of the surrounding hills, and the spring-water from the hills flows down between the layers, accumulating at the bottom in such a way that if the first stratum of rock is pierced at the bottom of the basin, the water rises through the superincumbent mass to the surface of the ground. The antique way of reaching the subterranean store was to dig by hand through the alluvial deposit to the rock, and pierce this in the simplest way. As the average depth to the water-bearing layer was two hundred feet, this was a serious undertaking for the poor Arabs, and the disciples of the horned prince, who alone had the right of well-digging, were accustomed to offer incense to the genii, and raise their spirits by a dose of hashish before commencing their task. The first operation was to dig in the sand a circular basin to catch any possible surface-water, and prevent it from running into the well where the "burrower" was at work. This done, the latter tied a rope of palm-fibre around his waist, leaving the end to the care of the villagers assembled at the mouth of the pit, and began digging a hole in the sand and gravel, removing the excavated material by means of a basket, which was drawn up and emptied by the volunteer assistants on the surface. As the pit deepened, it was necessary to stay the sides to prevent them from falling in, and this was done by means of small palm trunks. Time is not very precious in the desert, and a good many rests were necessary before the excavator reached the rocky crust beneath which the water stood. After a little experience, it was easy to determine the thickness and resistance of this stratum, and the debris on its surface was carefully removed, until only a thin shell remained. At this point the more adventurous spirits would, with a sudden blow, break the crust, signalling at the same time to their friends above ground, who would haul them up in time to escape the rising water. In many cases, however, the people on the surface were not active enough, and the excavator was drowned in his own well, so that the more cautious operators usually contented themselves with scraping the rock-crust as thin as they could with safety and breaking it, after they had themselves reached the surface, by dropping a large stone down the shaft. Unfortunately, for the people of the oases, these hand-made wells braced with wood, decayed in the course of centuries, the palm-trunks rotted, and the sand fell in, choking the well and shutting off the water-supply of the oasis, and by degrees the region relapsed into desert. In this condition the French found it, when their more scientific operations began. The first well sunk poured out a supply of a thousand gallons a minute, which formed a little river by itself, and the others, which were sunk in rapid succession, proved nearly as successful; so two years ago the Algerian portion alone of the district possessed six hundred and six wells, yielding more than sixty thousand gallons of water per minute, or about one-tenth the summer flow of the Seine at Paris. Most of these wells were sunk in the oases already existing, which they restored to their former fertility, but many were drilled in the desert itself, and new oases immediately sprang up around them. Dry and barren as is the desert soil, it produces vegetation abundantly as soon as it is moistened, and no sooner is a well opened than five to eight thousand palm-trees are planted around it and flourish admirably. It is hardly necessary to say that each of the new oases soon becomes a centre of population, and more than six thousand new inhabitants have already come to the district, while the annual value of its products has increased five-fold.

SAFE BUILDING.—XIX.[1]

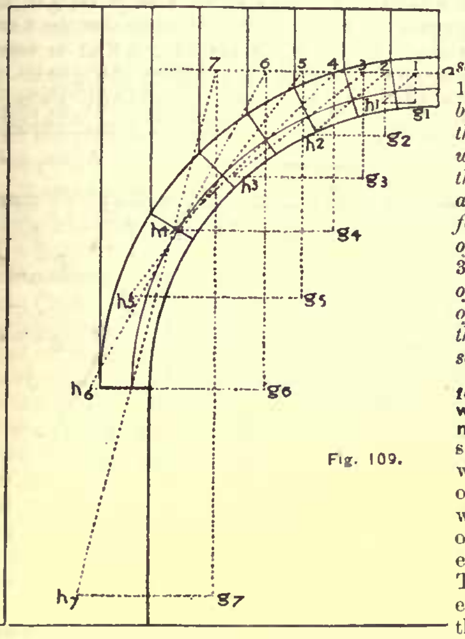


Fig. 109.

Example V.

A 12-inch brick semi-circular arch has 12 foot span. A solid brick wall is built over the arch to a level with one foot above the keystone. The abutment piers are 5 feet high to the spring of arch and are each 3 feet wide, including, of course, the width of skew-backs. Are the arch and piers safe?

Arch in fence-wall with abutment. As before, we will assume arch, pier, and wall over arch, each one foot thick. We will divide the load over arch into seven equally wide slices. This will make uneven voussoirs, but this does not matter, as our joint lines (and voussoirs) are only imaginary anyhow, and not necessarily of the shape of the actual voussoirs, which in brick would, of course, be represented by each single brick. The amount of the sums of each voussoir and its load, and the vertical neutral axis of the different sets are given by the arrows and lines G_1, G_2, G_3, etc. (in Fig. 110). When considering the safety of the abutment we treat it exactly the same as the voussoirs (and loads) of the arch; that is, we take the whole weight of the abutment, viz., C D E F I H C and find its neutral axis G_8.

Returning now to the arch, we go through the same process as before. We find the horizontal pressures (Fig. 109) $g_1 h_1$, $g_2 h_2$, etc. In this case we find that the last pressure $g_7 h_7$ is not as large as $g_6 h_6$; therefore we adopt the latter; it scales 1425 units or pounds. We now make (Fig. 110) $a\,o = 1425$ pounds; and $a\,b = 251$ pounds; $b\,c = 280$ pounds; $c\,d = 373$ pounds, etc.; $g\,h$ is equal to the last section of arch or 1782 pounds. We continue, however, and make $h\,i = 4600$ pounds = the weight of abutment. Draw $o\,a$, $o\,b$, $o\,c$, etc., to $o\,i$. Then get the tangents to the curve of pressure, as before, viz.: a 1 i_1 i_2 i_3 i_4 i_5 i_6 K_7; we now continue $i_6\,K_7$, which is parallel with $o\,h$ till it intersects the vertical axis G_8 of the abutment at i_7 and from thence we draw $i_7\,K_8$ parallel with $o\,i$.

Thrust on abutment. We will now examine the base joint I H of pier. I K_8 scales $10\frac{1}{4}''$, and as the pier is 36″ wide, K_8 is $7\frac{3}{4}''$ from the centre of joint. The area is $a = 12.36 = 432$ and the pressure is $p = o\,i = 9100$ pounds.

Therefore,

$$\text{Stress at I} = \frac{9100}{432} + 6.\frac{9100.7\frac{3}{4}}{432.36} = +48 \text{ pounds.}$$

and

$$\text{Stress at H} = \frac{9100}{432} - 6.\frac{9100.7\frac{3}{4}}{432.36} = -6 \text{ pounds.}$$

There is, therefore, a slight tendency for the pier to revolve around the point I, raising itself at H; still the tendency is so small, only 6 pounds per square inch, that we can safely pass the pier, so far as danger from thrust is concerned.

Joint C D at the spring of the arch looks rather dangerous, however, as $i_6\,i_7$ cuts it so near its edge D. Let us examine it. D K_7 measures $1\frac{1}{2}''$, therefore K_7 is $4\frac{1}{2}''$ from the centre of joint, which is 12″ wide. The area is, of course, $a = 12.\ 12 = 144$ and the pressure $p = o\,h = 4600$ pounds. Therefore,

$$\text{Stress at D} = \frac{4600}{144} + 6.\frac{4600.4\frac{1}{2}}{144.12} = +104 \text{ pounds.}$$

and

$$\text{Stress at C} = \frac{4600}{144} - 6.\frac{4600.4\frac{1}{2}}{144.12} = -40 \text{ pounds.}$$

It is evident, therefore, that the arch itself is not safe, and it should be designed deeper; that is, the joints should be made deeper (say, 16″), and a new calculation made.

Tie-rods to arches. If, instead of an abutment-pier, we had used an iron tie-rod, its sectional area would have to be sufficient to resist a tension equal to the greatest horizontal thrust $o\,a$; and care should be taken to proportion the washers at each end, large enough that they may have sufficient bearing-surface so as not to crush the material of the skew-backs.

Thus, in Example III, Fig. 105, if we should place the iron tie-rods to the beams 5 feet apart, they would resist a tension equal to five times the horizontal thrust $o\,a$, which, of course, was calculated for 1 foot only, or

$$t = 5.\ 2040 = 10200 \text{ pounds.}$$

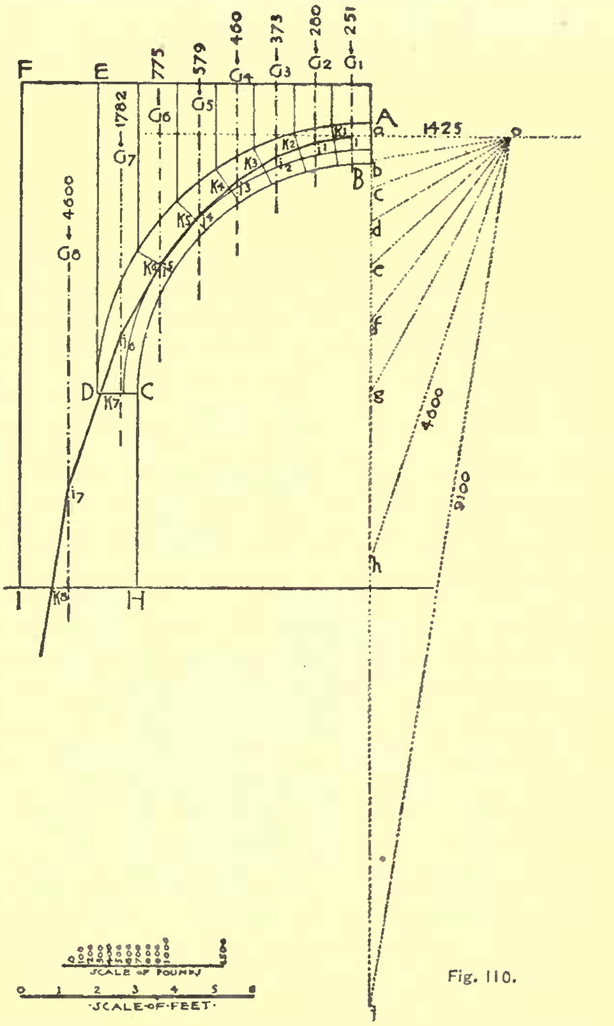


Fig. 110.

The safe resistance of wrought-iron to tension is from Table IV, 12000 pounds per square inch; we need, therefore:

$$\frac{10200}{12000} = 0{,}85 \text{ square inches}$$

of area in the rod; or the rod should be $1\frac{1}{16}''$ diameter. A 1″ or even $\frac{7}{8}''$ rod would probably be strong enough, however, as such small iron is apt to be better welded, and, consequently, stronger, and the load on the arch would probably be a "dead" one.

As the end of rod will bear directly against the iron beam, the washers need have but about $\frac{1}{4}''$ bearing all around the end of the rod, so that the nut would probably be large enough, and no washer be needed.

[1] Continued from page 161, No. 614.

GLOSSARY OF SYMBOLS.—The following letters, *in all cases*, will be found to express the same meaning, *unless distinctly otherwise stated*, viz.:—

a = *area*, in square inches.
b = *breadth*, in inches.
c = constant for *ultimate resistance to compression*, in pounds, per square inch.
d = *depth*, in inches.
e = constant for *modulus of elasticity*, in pounds-inch, that is, pounds per square inch.
f = *factor-of-safety*.
g = constant for *ultimate resistance to shearing*, per square inch, across the grain.
g_1 = constant for *ultimate resistance to shearing*, per square inch, lengthwise of the grain.
h = *height*, in inches.
i = *moment of inertia*, in inches. [See Table I.]
k = *ultimate modulus of rupture*, in pounds, per square inch.
l = *length*, in inches.
m = *moment or bending moment*, in pounds-inch.
n = *constant* in Rankine's formula for compression of long pillars. [See Table I.]
o = the *centre*.
p = the *amount* of the *left-hand re-action* (or support) of beams, in pounds.
q = the *amount* of the *right-hand re-action* (or support) of beams, in pounds.
r = *moment of resistance*, in inches. [See Table I.]
s = *strain*, in pounds.
t = constant for *ultimate resistance to tension*, in pounds, per square inch.
u = *uniform load*, in pounds.
v = *stress*, in pounds.
w = *load at centre*, in pounds.
x, y and z signify *unknown quantities*, either in pounds or inches.
δ = *total deflection*, in inches.
ρ^2 = *square of the radius of gyration*, in inches. [See Table I.]
𝔇 = *diameter*, in inches.
𝔯 = *radius*, in inches.
π = 3.14159, or, say, 3 1-7 signifies the *ratio of the circumference and diameter of a circle*.

If there are more than one of each kind, the second, third, etc., are indicated with the Roman numerals, as, for instance, a, a_{I}, a_{II}, a_{III}, etc., or b, b_{I}, b_{II}, b_{III}, etc.

In taking moments, or bending moments, strains, stresses, etc., to signify at what point they are taken, the letter signifying that point is added, as, for instance:—

m = moment or bending moment at *centre*.
m_A = " " " *point A*.
m_B = " " " *point B*.
m_X = " " " *point X*.
s = strain at *centre*.
s_B = " *point B*.
s_X = " *point X*.
v = stress at *centre*.
v_D = " *point D*.
v_X = " *point X*.
w = load at *centre*.
w_A = " *point A*.

Example VI.

A pier 28″ wide and 10′ high supports two abutting semi-circular arches; the right one a 20″ brick arch of 8′ span; the left one an 8″ brick arch of 3′ span. The loads on the arches are indicated in the Figure 111. *Is the pier safe?*

Uneven arches with central pier. The loads are so heavy compared to the weight of the voussoirs, that we will neglect the latter, in this case, and consider the vertical neutral axis of and the amount of each load as covering the voussoirs also; except in the case of the

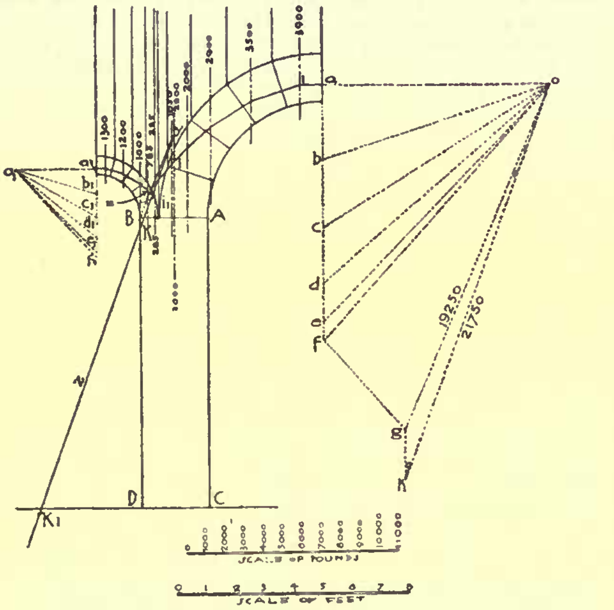


Fig. 111.

lower two voussoirs, where the axes are considerably affected. We find the curve of pressure of each arch as before.

For the large arch we would have the curve through a and i, for the small one through a_1 and i_1; the points i and i_1 being the intersections of the curve with the last vertical neutral axis of each arch. Now from i draw $i\,x$ parallel with $o\,f$, and from i_1 draw $i_1\,x$ (backwards), but parallel with $o_1\,f_1$ till the two lines intersect at x. Now make $f\,g$ parallel with and $= o_1\,f_1$, and draw $g\,h$ vertically $= 2600$ pounds $=$ the weight of the pier from the springing line to the base (1′ thick). Draw $o\,g$ and $o\,h$. Now returning to x, draw $x\,y$ parallel with $g\,o$ till it intersects the neutral axis of the pier at y, and from y draw $y\,Z$ parallel with $o\,h$ till it intersects the base joint C D of pier (or its prolongation) at K_1. Continue also $x\,y$ till it intersects the springing joint A B and K. Now, then, to get the stresses at joint A B we know that the width of joint is 28″, therefore $a = 28.12 = 336$; further $p = o\,g = 19250$ pounds, and as $B\,K$ scales one inch, K is distant 13″ from the centre of joint, therefore

$$\text{Stress at B} = \frac{19250}{336} + 6.\frac{19250.\ 13}{336.\ 28} = +\ 217 \text{ pounds.}$$

and

$$\text{Stress at A} = \frac{19250}{336} - 6.\frac{19250.\ 13}{336.\ 28} = -\ 102 \text{ pounds.}$$

Thrust on central pier. The arch, therefore, cannot safely carry such heavy loads. The pier we shall naturally expect to find still more unsafe, and in effect have, remembering that joint D C is 28″ wide, therefore, area 336 square inches, and as K_1 distant 54″ from centre of joint, and $p = o\,h = 21750$ pounds.

$$\text{Stress at D} = \frac{21750}{336} + 6.\frac{21750.\ 54}{336.\ 28} = +\ 813 \text{ pounds.}$$

and

$$\text{Stress at C} = \frac{21750}{336} - 6.\frac{21750.\ 54}{336.\ 28} = -\ 684 \text{ pounds.}$$

Relief through iron-work. The construction, therefore, must be radically changed, if the loads cannot be altered. If the arches are needed as ornamental features, they should be constructed to carry their own weight only, and iron-work overhead should carry the loads, and bear either nearer to, or directly over, the piers, as farther trials and calculations might call for. If this is done the wall **To avoid cracks.** should be left hollow under the end of iron-work until it gets its "set"; that is, until it has taken its full load and deflection; and then the wall should be pointed with soft "putty" mortar.

Example VII.

The foundations of a building rest on brick piers 6′ *wide and* 18′ *apart. The piers are joined by* 32″ *brick inverted arches and tied together* 8′ *above the spring of the arch. Piers and arches are* 3′ *thick. Load on central piers is* 72 *tons; on end pier* 60 *tons. Is this construction safe?*

Inverted arches. We will first examine the inner or left pier. The pier being 3′ thick and the load 72 tons, each 1′ of thickness will, of course, carry $\frac{72}{3} = 24$ tons. The width from centre to centre of piers is just 24′, so that each running foot of ground will receive a pressure of one ton. Now all we need to do is to imagine this pressure as the load on the arch. We can either draw the arch upside down with a load of one ton per foot, or we can make the drawing with the arch in correct position and the weights pressing upward, as shown in Fig. 112. We divide the load in five equal **Strength of arch.** slices, each about 2′ wide, therefore $= 2$ tons each. We make $a\,b = 2$ tons; $b\,c = 2$ tons, etc., and find the horizontal pressures $g_1\,h_1$, $g_2\,h_2$, etc., same as before. Again, $g_5\,h_5$

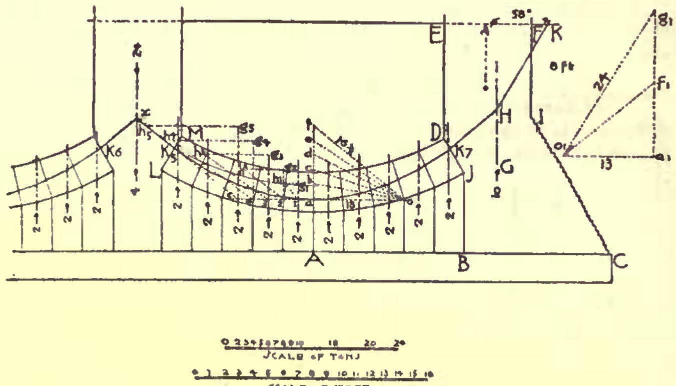


Fig. 112.

is the largest, measuring 13 units or tons. Now make $o\,a = 13$ tons, and draw $o\,b$, $o\,c$, etc. Construct the line a 1 K_5 or curve of pressure same as before. Joint L M is evidently the most strained one. We find M K_5 measures 11″, and as the arch is 32″ ($=$ M L), of course, K_5 is 5″ from the centre of joint. The area of joint is $a = 32.\ 12 = 384$. We scale $o\,f$, the pressure at K_5, and find that it measures $16\frac{1}{2}$ units, or 33000 pounds, therefore

$$\text{Stress at M} = \frac{33000}{384} + 6.\frac{33000.\ 5}{384.\ 32} = +\ 168 \text{ pounds.}$$

$$\text{Stress at L} = \frac{33000}{384} - 6.\frac{33000.\ 5}{384.\ 32} = +\ 6 \text{ pounds.}$$

Central pier. The arch, therefore, is perfectly safe. Of course, the left pier is safe, for being an inner pier the resistance $K_6\,x$ of the adjoining arch to the left will just counter-balance the thrust of our arch, or $K_5\,x$. But at the end (right) pier this is different. We, of course, proportion the length of foundation A C, to get same pressure as on rest of ground. The end pier carries 60 tons, or $\frac{60}{3} = 20$ tons per foot thick. The pressure per running foot on ground we found to be one ton, therefore A C should be 20 **Thrust on end pier.** feet long. The half-arch will take the pressure of 10 feet (from A to B) or 10 tons, and the balance (10 tons) will come on B C. This will act through its central axis G H, which, at the arch skew-back, will be half-way between the end of arch J and outside pier-line I F. This will, of course, deflect somewhat the abutment (or last pressure) line K_7 H of the arch. At any convenient place draw $o_1\,f_1$ vertically equal 10 tons, and $a_1\,o_1$ horizontally equal 13 tons, the already known horizontal pressure. Then K_7 H is, of course, parallel with and equal $o_1\,f_1$. Now make $f_1\,g_1 =$ 10 tons and draw $o\,g$. Now on the pier draw H K parallel with $o_1\,g_1$; H being the point of intersection of G H and K_7 H. As the pier is tied back 8′ above the arch, we take our joint-line at E F, being 8′ above D. We find, by scale, that K is 58″ from the centre of E F, the latter being 72″ wide. The area is $a = 72.\ 12 = 864$. And as $o_1\,g_1$ scales 24 units, the pressure is, of course, 24 tons or 48000 pounds, therefore:

$$\text{Stress at F} = \frac{48000}{864} + 6.\frac{48000.\ 58}{864.\ 72} = +\ 315 \text{ pounds.}$$

and

$$\text{Stress at E} = \frac{48000}{864} - 6.\frac{48000.\ 58}{864.\ 72} = -\ 207 \text{ pounds.}$$

Use of buttress. There is, therefore, no doubt of the insecurity of the end pier. Two courses for safety are now open. Either we can build a buttress sufficiently heavy to resist the thrust of the end arch, or we can tie the pier back. The former case is easily calculated; we simply include the mass of the buttress in the resistance and shift the axis G H to the centre of gravity of the area of pier and buttress up to joint E F. Of course, the buttress should be carried up to the joint-line E F, but it can taper away from there.

Use of tie-rods. If we tie back with iron we need sufficient area to resist a tension equal to the horizontal pressure $a\,o$, which in this case is 13 tons or 26000 pounds per foot thick of wall. As the wall is 3′ thick, the total horizontal thrust is 3. $26000 = 78000$ pounds. The tensional stress of wrought-iron being 12000 pounds per square inch, we need $\frac{78000}{12000} = 6\frac{1}{2}$ square inches area, or, say, two wrought-iron straps, 4″ x $\frac{7}{8}$″, one each side of pier. By this method the inner or left arch becomes practically the end arch. For the last two piers and the right arch become one solid mass; and not only is their entire weight thrown against the second or inner arch, but the centre of gravity of the whole mass shifts to the centre line of end

arch, or in our case 9′ *inside* of the end pier; so that there is no possible doubt of the strength of the abutment. There is one element of weakness, however, in the small bearing the pier has on the skew-back of the arch, the danger being of the pier cracking upwards and settling past and under the arch. This can be avoided, as already explained, by building a large bond-stone across the entire pier, forming skew-backs for the arch to bear against.

Example VIII.

A semi-circular dome, circular in plan, is 40′ inside diameter. The shell is 5′ thick at the spring and 2′ at the crown. The dome is of cut-stone. Will it stand?

Calculation of dome. We draw a section (Fig. 114) of the half-dome and treat it exactly the same as any other arch. The only difference is in the assumption of the weights. Instead of assuming the arch 1′ thick, we take with each voussoir its entire weight around one-half of the dome. Thus, in our case, we divide the section into six imaginary voussoirs. The weight on each voussoir will act through its centre of gravity. Now weight No. I will be equal to the area of the top voussoir multiplied by the circumference of a semi-circle with A B as radius. Similarly, No. II will be equal to the area of the second voussoir multiplied by the circumference of a semi-circle with A C as radius; No. III will be equal to the area of voussoir 3, multiplied by the circumference of a semi-circle with A D as radius, etc. The vertical neutral axes Nos. I, II, III, etc., act, of course, through the centres of gravity of their respective voussoirs. Now the top voussoir measures 5′ 6″ by an average thickness of 2′ 1″ or $5\frac{1}{2}$. $2\frac{1}{12} = 11{,}46$ or, say, $11\frac{1}{2}$ square feet.

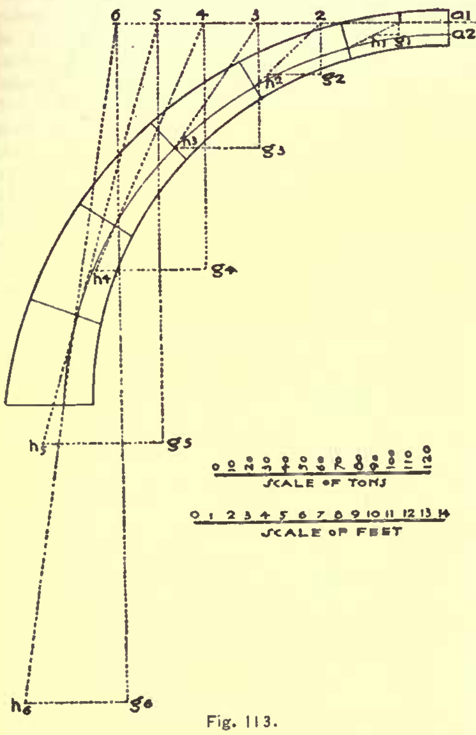


Fig. 113.

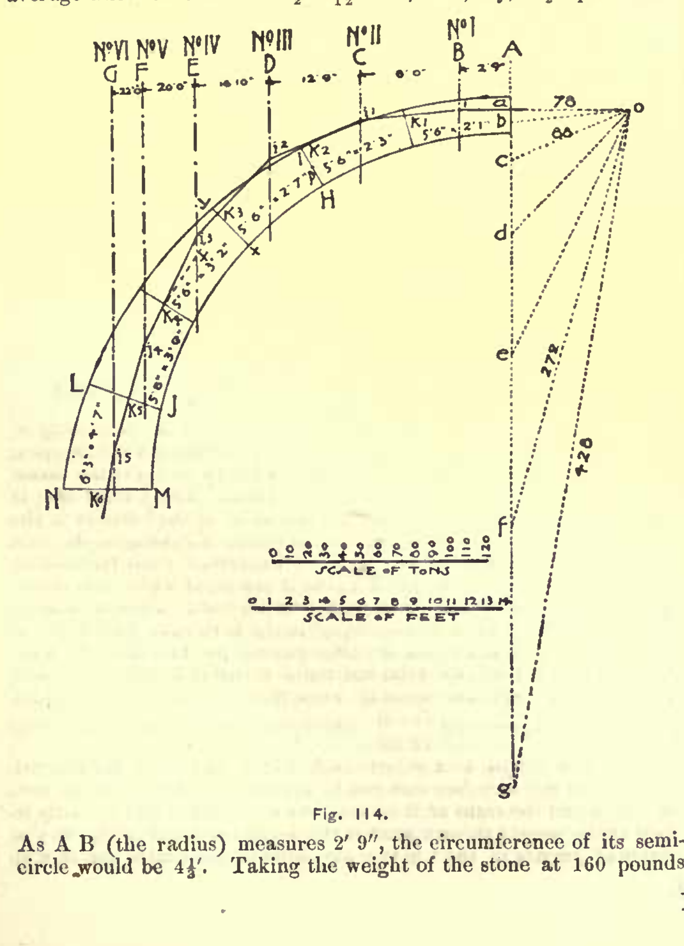


Fig. 114.

As A B (the radius) measures 2′ 9″, the circumference of its semi-circle would be $4\frac{1}{3}$′. Taking the weight of the stone at 160 pounds per cubic foot, we should then have the weight of No. I = 11,5. 8, 6. 160 = 15824 pounds, or, say, 8 tons.

Similarly we should have:

No. II = 12,4. 25,1. 160 =	49798	pounds, or,	say,	25	tons.
No. III = 14,2. 40. 160 =	90880	"	"	45	"
No. IV = 17,4. 52,7. 160 =	146716	"	"	73	"
No. V = 21,2. 62,8. 160 =	213017	"	"	106	"
No. VI = 28,7. 69,1. 160 =	317307	"	"	158	"

We now make $a\ b$ = 8 tons, $b\ c$ = 25 tons, $c\ d$ = 45 tons, $d\ e$ = 73 tons, $e\ f$ = 106 tons and $f\ g$ = 158 tons. We find the horizontal pressures $g_1\ h_1$, $g_2\ h_2$, etc. (in Fig. 113), same as before. In this case we find that the largest pressure is not the last one, but $g_5\ h_5$ which measures 78 units; we therefore select the latter and (in Fig. 114) make $a\ o = g_5\ h_5$ = 78 tons. Draw $o\ b$, $o\ c$, $o\ d$, etc., and construct the line a 1 $i_1\ i_2\ i_3\ i_4\ i_5\ K_6$, same as before. In this case we cannot tell at a glance which is the most strained voussoir joint, for at joint H I the pressure is not very great, but the line is farthest from the centre of joint. Again, while joint J L has not as much pressure as the bottom joint M N, the line is farther from the centre. We must, therefore, examine all three joints.

We will take H I first. The width of joint is 2′ 5″ or 29″. The pressure is $o\ c$, which scales 88 tons or 176000 pounds. The distance of K_2 from the centre of joint P is 16″. The area of the joint is, of course, the full area of the joint around one-half of the dome, or equal to H I multiplied by the circumference of a semi-circle with the distance of P from $a\ g$ as radius. The latter is 10′ 6″, therefore area $= 2\frac{5}{12}$. 16,5 = 40 square feet or 5760 square inches, therefore:

$$\text{Stress at I} = \frac{176000}{5760} + 6.\ \frac{176000.\ 16}{5760.\ 29} = +\ 131{,}7$$

$$\text{Stress at H} = \frac{176000}{5760} - 6.\ \frac{176000.\ 16}{5760.\ 29} = -\ 70{,}5$$

For joint J L we should have: the width of joint = 50″. The pressure $= o\ f$ = 272 tons or 544000 pounds. The distance of K_5 from the centre of joint is 8″, while for the area we have 50. $33\frac{1}{3}$. 12 = 20000 square inches, therefore:

$$\text{Stress at J} = \frac{544000}{20000} + 6.\ \frac{540000.\ 8}{20000.\ 50} = +\ 53 \text{ pounds.}$$

and

$$\text{Stress at L} = \frac{544000}{20000} - 6.\ \frac{540000.\ 8}{20000.\ 50} = +\ 1 \text{ pound.}$$

For the bottom joint M N we should have the width of joint = 60″. The pressure $= o\ g$ = 428 tons or 856000 pounds. The distance of K_6 from the centre of joint is 4″, while for the area we have 60. $35\frac{1}{3}$. 12 = 25440 square inches, therefore:

$$\text{Stress at M} = \frac{856000}{25440} + 6.\ \frac{856000.\ 4}{25440.\ 60} = +\ 47 \text{ pounds.}$$

and

$$\text{Stress at N} = \frac{856000}{25440} - 6.\ \frac{856000.\ 4}{25440.\ 60} = +\ 20 \text{ pounds.}$$

The arch, therefore, would seem perfectly safe except at the joint H I, where there is a tendency of the joint to open at H. Had we, however, remembered that this is an arch, lightly loaded, and started our line at the lower third of the crown joint, instead of at the upper joint, the line would have been quite different and undoubtedly safe. The dangerous point K_2 in that case would be much nearer the centre of joint, while the other lines and joints would not vary enough to call for a new calculation, and we can safely pass the arch. One thing must be noted, however, in making the new figure, and that is that the horizontal pressures $g_1\ h_1$, $g_2\ h_2$, etc. (in Fig. 113), would have to be changed, too, and would become somewhat larger than before, as the line a_1 6 would now drop to the level of a_2. A trial will show that the largest would again be $g_5\ h_5$, and would scale 80 units or tons, which should be used (in Fig. 114) in place of $a\ o$.

LOUIS DECOPPET BERG.

[To be continued.]

MUNICIPAL GRIEVANCES.

"And the wickedness of a soul is ignorance." — *The Divine Pymander.*



A ROMAN FRAGMENT. — the Museum of Dijon

THAT the American citizen is patient under grievances, long suffering under injury, is a fact too patent to need demonstration, yet we were astonished at being told so by our late distinguished guest, Herbert Spencer.

Of whom are our municipal governments and State legislatures composed? What does the successful money-getter know about the sanitary rules which should be considered in making laws for a great city? The power to grant charters for so-called public improvements should be made by men *éclairé* and belonging, in majority, to the liberal professions, especially to that of medicine. No charters should be granted to companies without due deliberation and a

conviction that their action will be for the greatest good to the greatest number. The first axiom of American stock companies is that people are made for stock companies, not stock companies to minister to the public. The public is regarded as a cow to be milked for these companies, and it matters not what the effect of their contrivances is on the public health. Every possible outrage may be committed in the name of a stock company, and the public has no rights a company is bound to respect. This is called progress. Liberty, both collective and individual, is throttled. Herbert Spencer says, "The Americans retain the forms of freedom, but so far as I can gather there has been considerable loss of the substance." The man who could free the country from the grasp of corporations would be a second Washington. Above all, the charters issued to companies to use the public highways should be in the interest of the majority. Take, for example, the public steam-heating companies; it is in no wise in the interest of the general public that these charters have been obtained. Public steam-heating, radiating from a central station, has been anything but a public benefit, the advantage, if there be any, being confined to a limited number of persons outside of the company. The first effect is to melt the frost and snow on the side of the street where the pipes are located, and to make a river of slush, while the other side is an inclined plane by the progressive action of the heat. Thus pleasant or safe driving is rendered impossible. The steam, which is seen rising from around the centres of the man-holes, gives one the impression of being in a country of partially-extinct volcanoes or geysers, and many runaway horses are the result.

Several New York physicians testify that the steam companies' excavations have produced "a considerable amount of malarial disease of a severe character." It is to be hoped that the high-handed usurpations of the steam-heating companies will meet its Waterloo before all our roadways are converted into hot-beds or nurseries of malaria by steam-heating appliances. The mud of cities is composed largely of dangerous filth. In the winter nature provides that the germs of disease, more or less included in this filth, should be inert from the action of cold. This benevolent intention of nature is rendered abortive by steam-pipes, the heat drying the dirt, and the winter winds disseminating it about the streets and in our houses. If our streets were properly paved, with lava or cemented blocks of stone, this evil would not be so great. Inside of the man-holes is a large iron bulb or steam-chamber, kept at a very high temperature. In the hollow space surrounding it settles a quantity of filthy water, the draining of the street. This is kept in a perpetual state of ebullition, and it is from this dangerous water that the steam is seen rising. When the man-holes are filled, they are baled out at night, the companies being, probably, ashamed to allow the public to witness the operation by daylight. The foul water is turned into the gutters, where it may become a source of disease. The noxious odor from this fetid water is conveyed by the large wooden pipes, in which the small iron steam-tube is enclosed, into the cellars of houses and thence distributed as a "modern convenience" throughout the mansion to enrich, later, doctors and undertakers. Besides the more or less intense heat, steam is disengaged from the apparatus into the cellar by leakage, etc. Unless the floor of the cellar is thoroughly cemented, the heat must call forth the ground air. Besides these difficulties is the possibility of explosion. In several instances, the iron disc covering the man-hole has been thrown into the air, injuring passers-by.

Whatever may be said in favor of private steam-heating, the warming of buildings from a common central apparatus is an unwarrantable and flagrant violation of the rights of a majority, designed to benefit a few at the expense of the health and convenience of the many. When will legislators learn that the highways of a city belong to the people, and that they have no right to give charters to any company that interferes with the health and convenience of the frequenters of a highway. If majorities govern, the number of promenaders using a street is greater than the number of persons supposed to be benefited. Our rights as a people are constantly disposed of by our city and State governments, from the wicked alienation of our fair lands at the far west, to the charters won by bribery from our boodle aldermen. The perpetual repairing of the steam-pipes, the upturning of the streets consequent thereupon, as well as during the original installation, distributing malaria from the upturned ground, is an unwarrantable infringement of human rights, for which no legislature or city council ought to give a charter. The millennium may come, but it will never be possible to put heat, moisture and dirt together without harmful bacteria. Tropical heat, moisture and filth will produce the same effect in a great city as in a South American jungle.

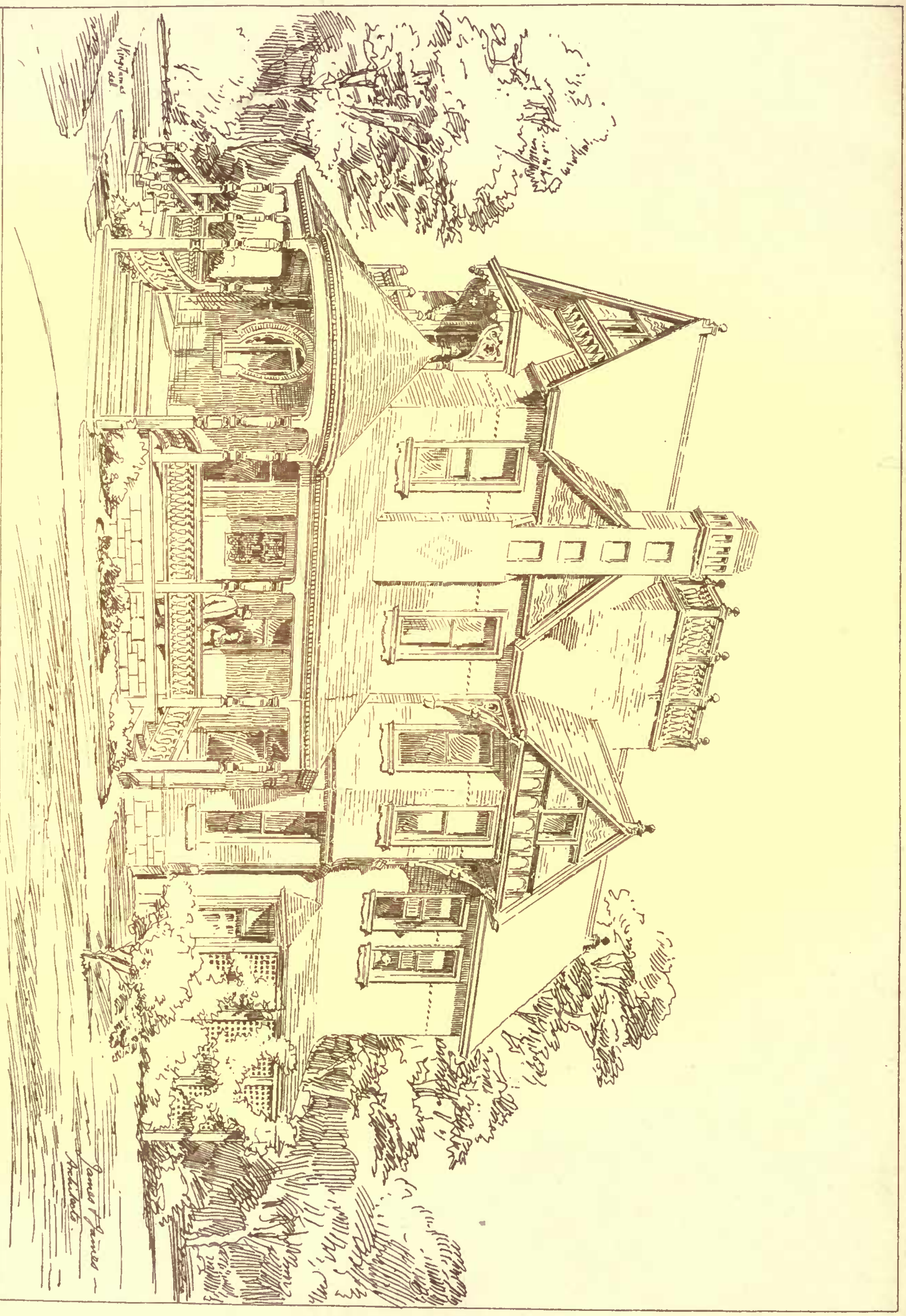
Nor is the present system of electric-lighting in America safe from indictment. There is no reason for allowing the streets to be disfigured with poles forty feet in height with a blinding light at the summit, which brightens or decreases in a manner trying to the eyesight. These flickering or uneven lights are a torment to many persons in their vicinity. Nature means the night for silence and repose. There should be enough artificial light to see one's way perfectly, but not enough to turn night into day. The defects of our cities, the dirt and ill-kept walks, are covered at night by the charitable veil of a semi-obscurity, and, even on that account, an evening walk has its charms. Sunshine and shadow should succeed each other and the rights of the moon should be respected. The changes from day to night are necessary to health and happiness, or nature would not have instituted them. She puts out and draws in her forces with an eternal rhythm. Large lights have their place on the railroad depots, or on the parks, and on trans-Atlantic steamers, but for the street they should be no larger than those used in stores, and absolutely free from wires or any disfiguring apparatus. Why do not the electric companies study the system of electric-lighting in Paris known as the Jablochkoff system? The electric iron lamp-posts in Paris are scarcely higher than our street gas-lamps, artistic in model, and the light mellowed by ground-glass shades. No wires or other apparatus are visible. We lose, in over-lighted thoroughfares, the mysterious beauty of the night and the repose it brings to the spirit worn with the toils of the day.

The same disregard of the public rights is shown in granting permission to telephone companies to place their disgraceful-looking wires on everybody's houses, with or without permission, often the latter, till the city appears to be covered with a gigantic spider's web. The ugly-looking poles disfigure the streets, while storms shatter wires and poles to the danger of public travel. Many of these telephones are of no greater utility than for affluent families to order their beefsteaks and groceries, articles which, in these days of adulteration, would be much better bought after personal inspection. It may be well enough to erect great poles for telegraphs and telephones on country roads and in small towns, but they are clearly out of place in great cities. Neither is the proposition to bury them much better, as that necessitates more digging up of the streets, more malaria therefrom, and more inconvenience to the already long-suffering denizens of the city. In large cities, the main sewers should pass through subterranean streets, properly sidewalked, and lighted with gas, while along its sides should be placed the gas-pipes, water-mains, and telegraph-wires, just as in Paris. If we refuse to take this trouble, necessary to the well-being of our cities, the telegraph-poles should cease at the outskirts of the city, where the principal office might be located, and despatches sent to and from the office by bicyclists. The telegraph nuisance might be abated somewhat by raising the price and confining it principally to business houses.

Still more objectionable are elevated railroads. A judicious ceinture road running round New York, with surface-cars propelled by electricity, from the circumference to the principal streets, would have been much better. The disfiguring scaffolding and the noise and darkness that elevated roads make are too much of an annoyance to be tolerated. What sort of nervous constitutions will the human beings born and brought up amid the ceaseless din of elevated railways possess? In any case, the charters for elevated roads and steam-heating are ones no city government has any right to give without the votes of the townspeople, and some other plan than elevated railroads should be devised to meet the demands for rapid transit. Even cars running by electricity on the old tramways would have been preferable, the railroad being enclosed by an iron fence, and crossings at certain intervals could have been made by inclined planes over or under the railway. Cars and roads can be so constructed as to run with much less noise, as is the case in Continental countries. The danger of locomotion in the air is not the least of the objections to elevated roads. The greatest is the effect on the nervous constitutions of the people who live along the line.

The principles of government as laid down by the constitution of the United States and the Declaration of Independence are assuredly the noblest ever inscribed in any constitution, but the real, only liberty now remaining to us is that any one can put his hand in his neighbor's pocket, and that great corporations, which make a monopoly of everything we eat and drink and wear, may be formed to fleece the public, already shorn to the last lock. The consequence of all this is that living is dearer in the United States than in any civilized country in the world. Of real liberty we have none. Only the poor privilege, denied in foreign countries, remains, that of anathematizing and abusing the government—a small compensation for the real liberty we have lost. Our filthy, ill-kept streets, destitute of anything like adequate pavement, our want of proper machines for cleaning them, the painful economies in the most important sanitary matters, while our boodle law-makers drink champagne at the tax-payer's expense, bear witness to the truth of what I say. There is one thing worse than effete monarchies and that is effete peoples and an effete public such as most of our great cities present.

Hartford is, perhaps, a case in point. Right through the centre of the city courses a narrow, sluggish stream, now an open sewer, which would disgrace mediæval times, and such is the want of sanitary knowledge that a mill-owner, to whom in ancient times the city sold the right to draw off the water, still does so almost nightly for milling purposes, leaving the wind to distribute, from its reeking banks and bed, the millions of seeds of typhoid-fever, scarlet-fever, and dissolved diphtheria membranes among the population when asleep and in the negative condition favorable to inception of contagious diseases. The city cannot afford to rectify this state of affairs, but could afford to pay $150,000 for a soldiers' monument, which stands at the side and presides over this open sewer, and which should do honor, not only to the patriotic victims of the war, but to the still larger number of citizens, though no inscription records their fate, who have succumbed yearly to the attacks of their invisible and innumerable foes cultured in this sewer. Mark Twain, who addressed the veterans of the Grand Army of the Republic in Hartford three years ago, intimated that though great honor was due to the brave men who went to the war, perhaps even more was due to



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Houses on West Seventy First St

Residence of Mrs. Harriet N. Andrews

Lamb and Rich, Architects

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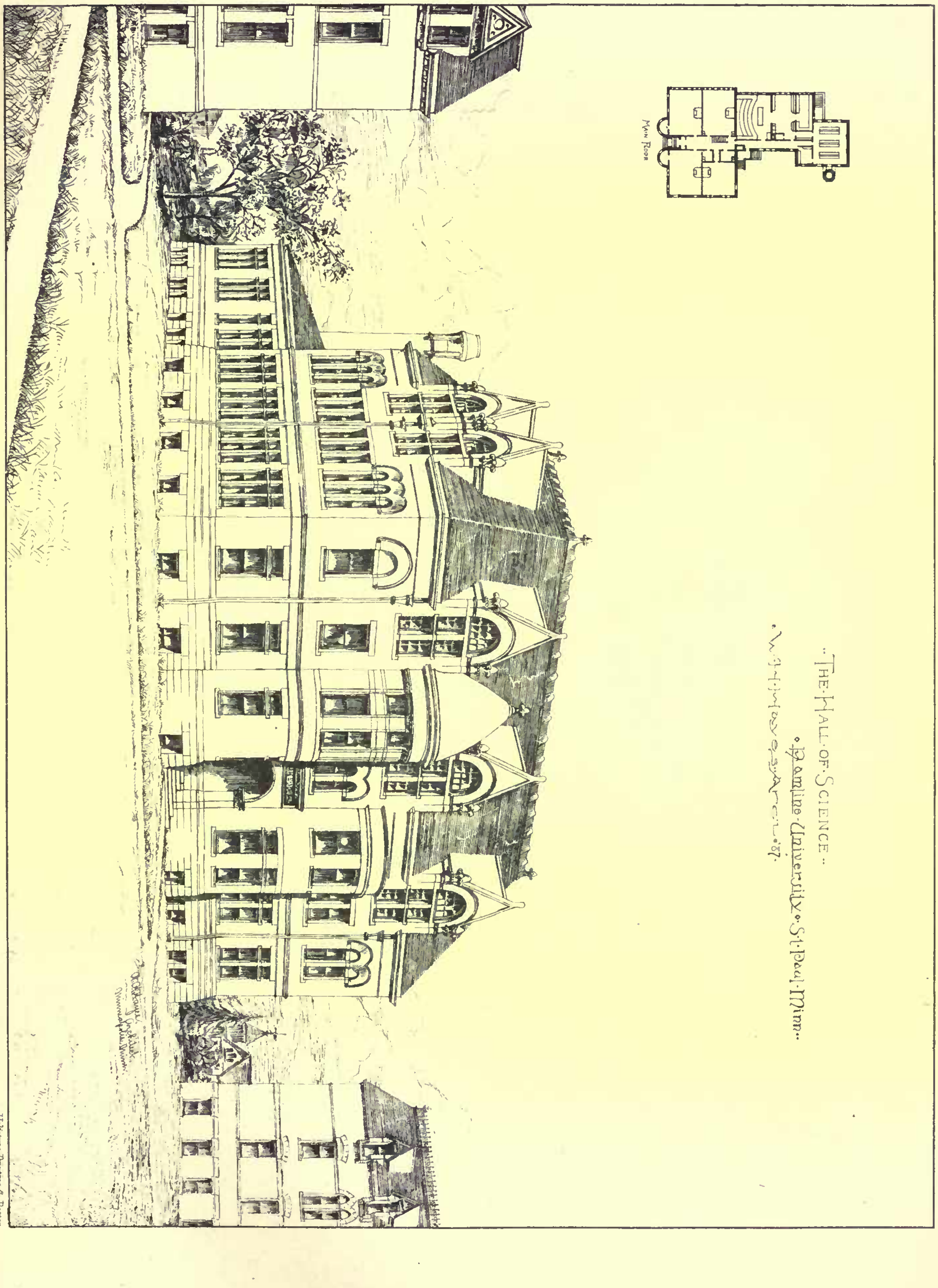
American Architect and Building News, Nov. 5 1887.

· Church of the Sacred Heart ·
· Dayton, Ohio ·

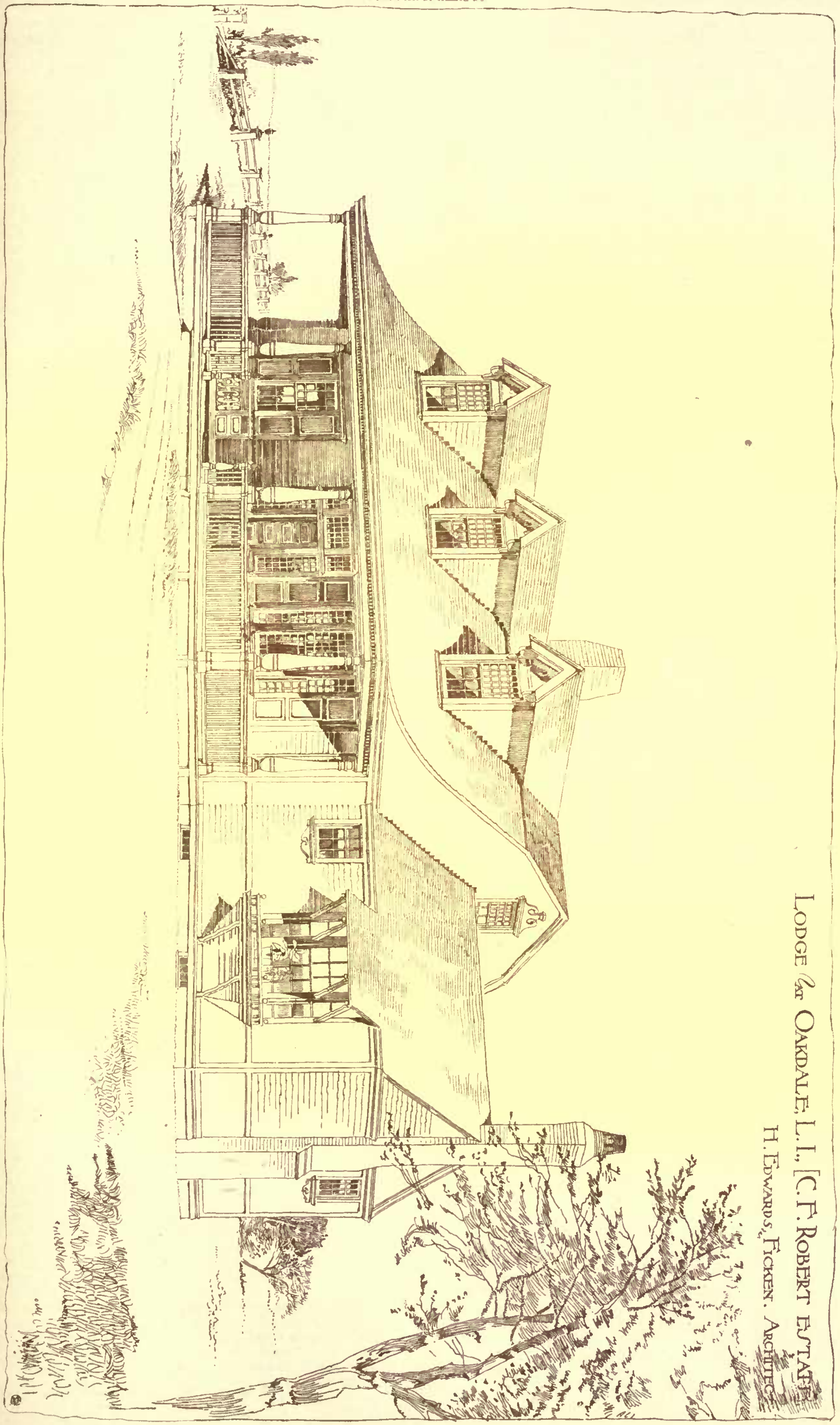
: Chas. I. Williams, Architect :



AMERICAN ARCHITECT AND BUILDING NEWS, NOV. 5 1887 No. 619



Heliotype Printing Co. Boston.



LODGE AT OAKDALE, L. I., C. F. ROBERT ESTATE.
H. EDWARDS FICKEN. ARCHITECT.

Heliotype Printing Co Boston

those who remained at home and risked their lives daily, as he did, in passing Park River sewer. Statistics show that only ten per cent of those who go to war perish by lead, while in Hartford, in July, 1887, the mortality of this city of 50,000 encamped around an open sewer was thirty-seven per thousand, showing a murderous loss of life, since Chadwick, the sanitary father of Great Britain, says "cities can reduce their mortality to five per thousand." The village, of more than 1,500 model houses for the working classes, built by the late earl of Shaftesbury at Clapham, near London, shows a mortality of only twelve per thousand, showing how sanitary surroundings can affect the death-rate. The garbage in this not model city of the Puritans, Hartford, is also unhealthfully disposed of by a private company, which throws it onto certain low-lying city lands, which later will be building-lots, instead of consuming it, as should be done, in a rubbish furnace similar to the one used with great success in Leeds, England, which would cost the city only a moderate sum and decrease the taxes of the tax-payers for the hospital and poor-house.

The object intended to be emphasized in this essay is that the thoroughfares, streets and even lanes of a city or town belong to the sovereign people; that no one has a right to dispose of any part of them in the interest of a few favored ones against safe, easy, and commodious transit, or in any way to offend even the artistic perceptions of its frequenters. It should, on the contrary, be the pride and delight of all the dwellers of a city to keep its thoroughfares in as perfect order as possible, that we may love our abiding-place as the ancient Romans loved the Eternal City and as the Parisians of to-day love Paris.

SARAH GILMAN YOUNG.

THE ILLUSTRATIONS

[*Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.*]

BUILDING OF THE STANDARD LIFE ASSURANCE ASSOCIATION, MONTREAL, P. Q. MR. R. A. WAITE, ARCHITECT, BUFFALO, N. Y.

[Gelatine Print, issued only with the Imperial Edition.]

HALL OF SCIENCE, HAMLINE UNIVERSITY, ST. PAUL, MINN. MR. WARREN H. HAYES, ARCHITECT, MINNEAPOLIS, MINN.

THIS structure is now being roofed, and will be occupied for the winter term. The walls are faced with a sand-moulded red brick laid in chocolate-colored mortar and relieved with brown sandstone from Bayfield, Lake Superior. Roof of black slate. Interior finish of oak and other native woods finished on the natural grain. Cost of building complete, $45,000, including heating and plumbing.

HOUSE OF T. J. COOKSON, ESQ., KANSAS CITY, MO. MESSRS. JAMES & JAMES, ARCHITECTS, KANSAS CITY, MO.

THE first story of this house is of brick, the second is shingled, and the roof is covered with "Cortland" steel plates.

LODGE FOR C. F. ROBERT'S ESTATE, OAKDALE, LONG ISLAND, N. Y. MR. H. EDWARDS-FICKEN, ARCHITECT, NEW YORK, N. Y.

CHURCH OF THE SACRED HEART, DAYTON, O. MR. C. I. WILLIAMS, ARCHITECT, DAYTON, O.

HOUSES ON WEST SEVENTY-FIRST STREET, NEW YORK, N. Y. MESSRS. LAMB & RICH, ARCHITECTS, NEW YORK, N. Y.

IRON STAIRCASES.[1]

Fig 10



STAIRCASES serve as a means of communication between the several stories in a building. They are a succession of steps, or grades, supported by, and framed into, one another on the slant, and consist of a horizontal part called foothold or tread, and of a horizontal part, the riser.

Of the Foothold. — In straight staircases, the breadth of the step taken midway between the extremities is the foot-print. In balanced staircases, or such as have dancing-steps exceeding one metre in length, the breadth of tread or foot-print must be taken parallel to the horizontal projection of the hand-rail at fifty centimetres distance therefrom. The line formed by the successive foot-prints is called the line of traffic. This distance of fifty centimetres from the hand-rail represents the position of a person ascending or descending and holding the rail.

Balancing. — The breadth of the treads in their curved or straight portions is arrived at by making a drawing on the floor or wall. First, the number of dancing-steps or winders deemed indispensable is determined, and then the minimum dimension of the smallest inner angle. In the next place, the compasses are brought into requisition to settle the measurement of the tread in the centre, gradually decreasing the opening until it equals the measurement of the smallest inner angle, taken as a starting-point. It is by a tentative process, rendered easy by practice, that the best result is obtained. Geometrical methods are hardly ever resorted to.

Height and Breadth of the Steps and Landings. — The height and breadth of the steps are very variable quantities, generally subject

Fig 1

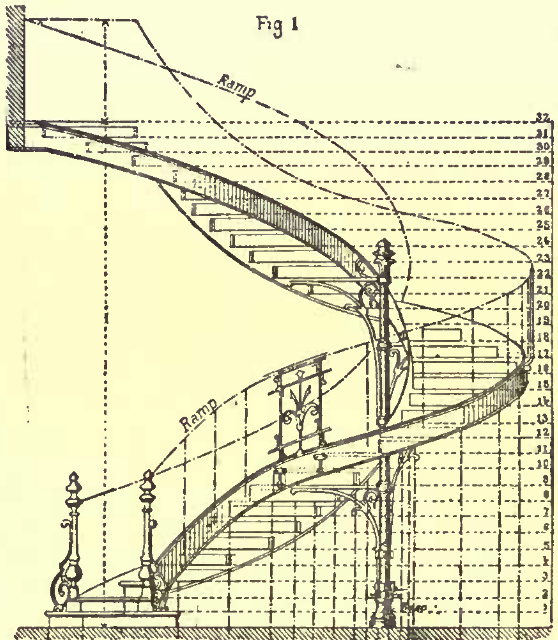
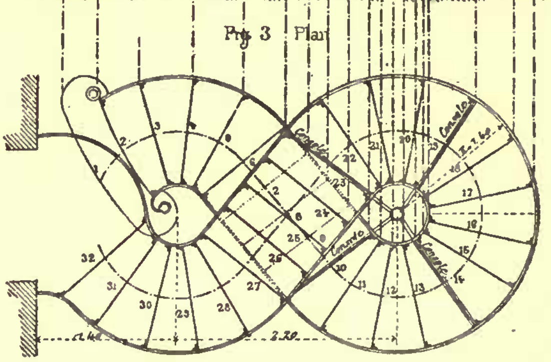
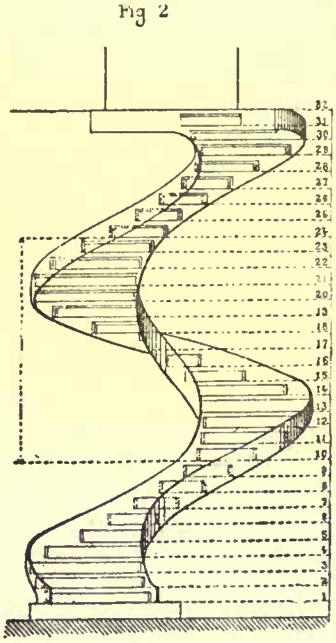


Fig 3 Plan



to the exigencies of the space reserved for a staircase. As a rule, the broader the tread at the line of traffic, the less ought to be the riser or the height of a step. The breadth of the tread varies from 23 to 40 centimetres, and the height of the risers from 11 to 19 centimetres, a maximum and minimum that should never be exceeded. The most ordinary dimensions are from 25 to 35 centimetres for breadth, and about 16 centimetres for height. Within these limits stairs are always easy of ascent and not tiring. On the ground floor it is usual to allow more breadth for the first three steps; for the first step, an extra 3 centimetres; for the second, 2 centimetres; for the third, 1 centimetre extra. Thus, for instance, in a staircase of which the breadth of tread is equal to 30 centimetres, the first step will be 33, the second 32, and the third 31 centimetres. Where we are not obliged to observe fixed dimensions in the staircase cage and in the height of ascent in getting out plans, the step may be set down as $2\ h. + b = 60$ to 66 centimetres, or twice the height and once the breadth equal 60 to 66 centimetres, a formula that works out well. An ordinary staircase to be convenient should be kept to a pitch ranging from 24° to 30°. It should consist of steps uniform in height, at least, in each flight or difference of level between the floors of each story, measured from flooring to flooring. The landings should be 80 centimetres broad as a minimum, and in any case not fall short of the sum of three steps measured horizontally at centre of the tread. This remark

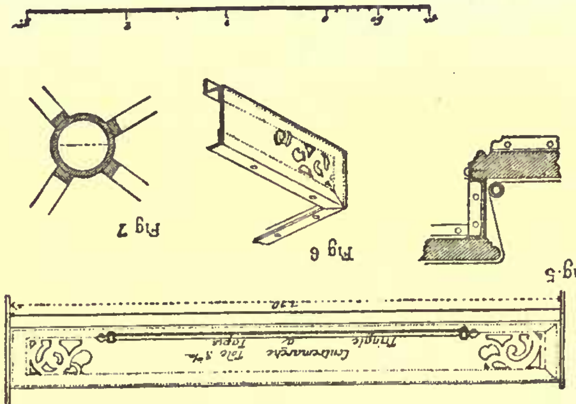
Fig 2



[1] From "*Nouvelles Annales de la Construction.*"

applies particularly to back stairs and small staircases, where space is limited. Speaking generally, landings should be made as broad as possible.

Character and Dimensions of Stairs.—Steps are made in chequered masonry, cement, etc., of fir, pitch-pine, beech (rarely), stone, marble and iron. Thicknesses for wooden steps in staircases vary from 27 to 54 millimetres. In large staircases, such as we find in railway stations, for instance, the thickness of the tread attains to as much as 7 centimetres (planing will reduce it by 3 to 4 millimetres). The thickness in the case of stone or marble varies from 6 to 8 centimetres. However, in staircases not exposed to rough usage, marble slabs may be used as thin as 3 centimetres as a minimum, provided they be fairly and squarely placed on a bed of plaster.



Head-Room or Height of Passage.—An important question in the construction of staircases, and which should be well considered in working out the plans, is the allowance of a sufficiency of head-room. In stairs of the most usual style, those of the ordinary dwelling-house let out in flats, we must bear in mind: 1. The head-room in the stairs leading down to the cellars. Fourteen steps are required as a minimum, to allow 2 metres for the cellar door, a height which, according to the importance of a house and its destined uses, may be reduced to 1 metre and 80 centimetres, or even to $1\frac{3}{4}$ metres. 2. The ground floor, always having a greater elevation than the other stories, requires a larger number of steps, which can only be provided by advancing the point of departure to make up the difference, the consequence being that the landing of the first story must stand over the sixth or seventh step, thus reducing the head-room by that much. Now, to get over this difficulty, we may increase the height of the steps in order to lessen their number, and thus bring the landing over the third or fourth steps. The steps of the first revolution may, without disadvantage, be increased in height by 8 to 10 millimetres, and it is more particularly in the upper stories that the rise of the steps should be kept down as much as possible. The head-room should not fall short of 2 metres and 20 centimetres; below this height the moving of the furniture is apt to spoil the ceiling. The starting-point of a staircase should be placed beneath the first-floor landing.

Fig. 8

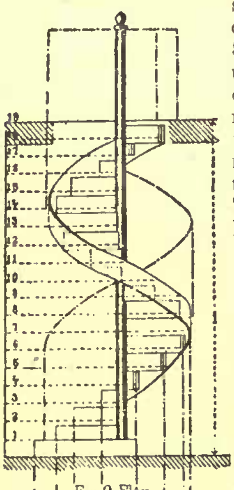
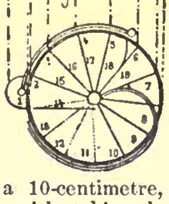


Fig. 9 Plan



VARIETIES OF STAIRCASES.

The "Miller's Steps."—This style of stair is simply a straight flight of treads without risers, with a pitch sometimes attaining to and even exceeding 45°. The treads are about 20 centimetres in breadth and 20 centimetres in height. The same arrangement is adopted for cellar stairs.

Straight Flight Stairs.—These are generally used as outside stairs. Their dimensions are the usual ones; viz., 90 to 120 centimetres for length of step, and they can be supported by means of brackets, columns, or posts. In the example we give, Figure 17, the string-board consists of two T-irons, 45 inches by 50 inches, united by means of 4 millimetre iron braces or plates, and rests upon a 10-centimetre, cross-shaped iron, into which the lower T-irons vanish, taking the shape of brackets. Figures 18 and 19 show the jointing. A rack made of flat iron, 30 inches by 7 inches, receives the risers and treads made of striated sheet-iron, the other extremity of which is run into the wall. Figure 20 is the staircase on plan.

Stairs between Walls.—In this mode of construction there is no string-board, the treads and risers being built into the wall at each end, and the masonry walls serve alike as supports and as hand-rails for the stairs. Sometimes a hand-rail is let into the wall, consisting of a round iron rod or an iron bar cased in a wooden rail.

Helicoid, Spiral or "Limaçon" (Snail-shaped) Staircases (Figs. 1 to 10).—These stairs are of two kinds: first, those built round a solid newel-post supporting all the steps (Fig. 8), in which each riser is a species of independent gibbet, joined to the rest by the string-board. When such stairs are contained in a cage, the string-board is dispensed with, and the steps are built into the wall. If there be points of contact only with the walls, it is right to avail one's self of them to fix a string-board, so as to relieve the strain on the risers.

Plan of a "Limaçon" or Snail-shaped Staircase.—This form of stair finds its application in warehouses, shops, etc., for purposes of direct communication either with the basement or the first floor. The available space in such cases is limited as a rule, and these staircases at times are reduced to 50 or even 45 centimetres length in the treads. So reduced, the central portion, or rather, the breadth

Fig 11 Elevation

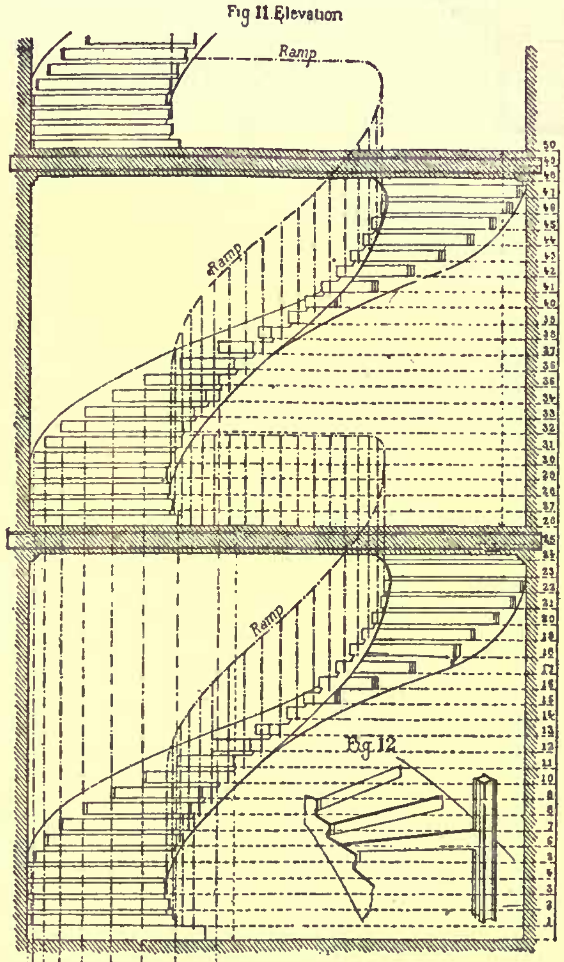
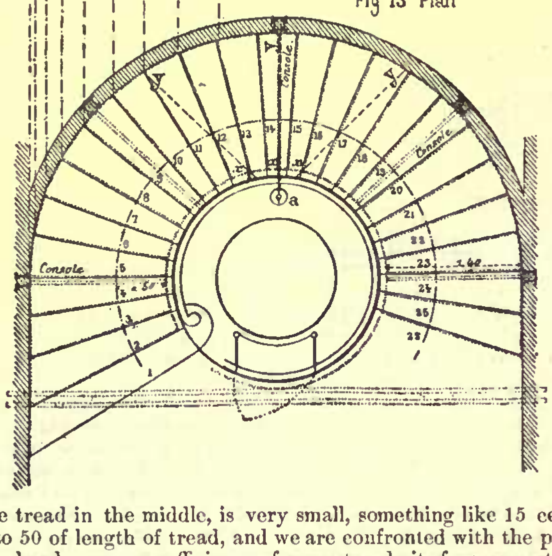


Fig 13 Plan



of the tread in the middle, is very small, something like 15 centimetres to 50 of length of tread, and we are confronted with the problem of the head-room, or sufficiency of space to admit of persons standing erect in ascending and descending. This height, with rare exceptions and to admit of the staircase fulfilling the necessary requirements, should never be less than 1 metre 85 centimetres to 1 metre 90 centimetres. It will be readily understood that in such cases it becomes impossible to increase the breadth of the treads. If, for instance, we desire to have 25 centimetres to give the foot a solid rest, we shall get, in working out a snail-shaped staircase of 50 centimetres length of tread, a radius of 30 centimetres, taking the radius

of a newel of 10 centimetres, say $2 \pi R = 1.8849$ metre of circumference at the middle of the step, and if we divided 1.8849 metre by 25 centimetres, we should obtain about seven and a half steps or treads. Let us take eight, and reckoning on a maximum of 19 centimetres of height, we shall get 1 metre and 52 centimetres of elevation between the No. 1 and the No. 8 treads, an insufficient space to stand erect in. To save the loss of time involved in a process of groping, we shall here offer a method of setting out adopted by specialists in the building trade, which always insures sufficient head-room. The dimensions of space and height of ascent being determined, let the circumference be divided into 13 equal parts (Fig. 9), and the height into parts of 17 centimetres as a minimum. Thirteen treads on plan give 14 heights. By deducting that of the fourteenth, there will be secured free passage, $17 \times 13 = 2.21$ m.; and if we take into account the head-room at the landing, we shall have to deduct two treads, or 2.21 m. — 0.34 = 1.87 m. To increase the head-room as much as possible, the landing is shaped into a curve, as shown in Figure 9. In building with iron, the newel-post is made, according to the lengths of the treads, of tubes measuring from 8 to 14 centimetres diameter, the string-board of 3 to 6 millimetres hoop or sheet iron, and the risers of from $2\frac{1}{2}$ to 3 millimetres thickness. The risers are invested at the top and bottom with angle-irons, and likewise at their extremities, and jointed by means of screws to the newel-post and the string-board. We show at Figure 10 an arrangement of great solidity, which allows in staircases of small dimensions of substituting a plain, flat sheet of iron, 50 by 7, in the room of the string-board. This plan consists of making the angle-iron, forming the border for the tread at the outer end, broader in the wing — say about 45 millimetres — and of putting a bolt of 14 millimetres through the newel-post which keeps together the ascending flight. The second type of winding or spiral staircase has a hollow newel. It is more properly called an open circular staircase. This is far more convenient than the staircase with a solid newel, but it involves the necessity of finding more space, though not so much as the square, rectangular, and other types of stairs. It lends itself more readily to purposes of decoration, and may be used for private houses, shops, offices, etc.

Fig 14. Elevation

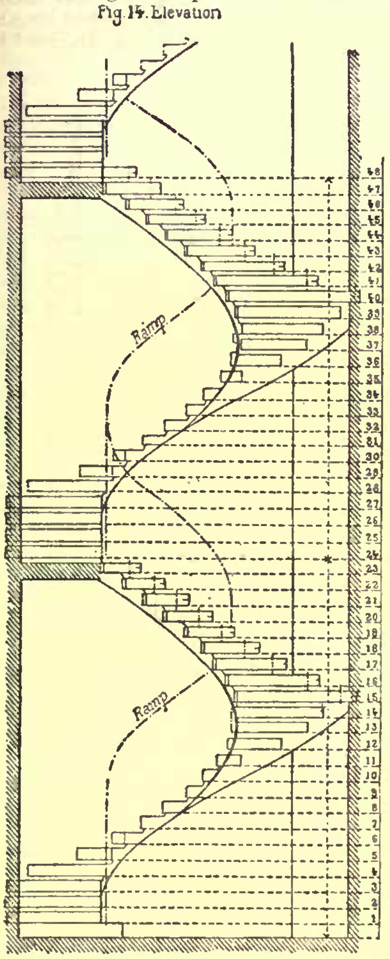


Fig 15 Plan

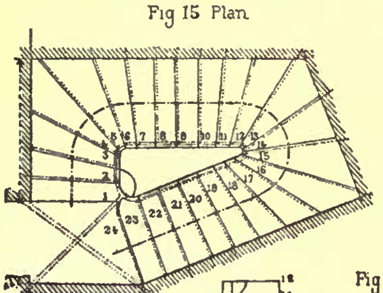
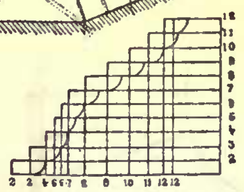


Fig 16



The hollow or open space should be kept to from 40 to 60 centimetres measurement. The oval and elliptical forms are adaptations of this type; the figure-of-eight shaped one, shown in Figure 3, is very effective. It is just precisely in such special types that iron shows all its many advantages, both as regards the manufacture, the setting out, the bevelling, and the elegance, lightness, and delicacy of form. The construction of the type we present in Figures 1, 2, 3, 4, 5, 6, and 7 is of the simplest. A double string-board, taking the form indicated, is bound together by sheet-iron risers, fitted with angle-irons and Z-irons, as per Figure 4. Open scroll-work at each end lightens the structure as a whole, while a carpet of 70 to 75 centimetres width, laid down in the centre, is secured by stair-rods held by eyes, as seen in Figure 6.

Figure 5 is a section of the riser. One of the rings of the 8 is carried by a small central column, the bearing-strain on which is distributed by four brackets. This small column may be converted into a lamp-post, a bracket-burner with globes, or any other decorative mode of illumination. The upper portion is supported either by carriages (as we shall describe in the sequel when treating of the landings) or by brackets, or by a second column placed in the axis of the ring of 8. This staircase can also be constructed with four columns placed at the points of intersection, formed on the plan by the string-boards. Circular staircases may be adopted also in the case of large houses let out in flats, but in these we must provide for a well-hole of considerable dimensions and large landings. The length of the steps would here vary from $1\frac{1}{5}$ to $1\frac{1}{2}$ metres. The instance we give in Figures 11, 12, and 13 is that of a stair contained in a cage built of iron of 15 centimetres thickness, coating included, as housing becomes impossible in a thin partition. Each flight rests upon five 11-millimetre iron-plate brackets built into the masonry, bolted between the double metallic uprights of the iron casing, and connected with the string-board by means of stout iron squares. To bind the risers there is a false string-board of 5 millimetre iron-plate running round the circumference of the cage. This staircase is adapted to receive a lift. The well-hole measures 1 metre 90 centimetres inside the flight. A lift-cage of $1\frac{1}{5}$ metres diameter can very well be made to work in it, keeping it sufficiently away from the edge of the stairs to avoid the guillotine action which would take place if the lift passed too close to the outer string. To effect this we must adapt the flight by raising it, or must fit the well-hole with a metallic netting which gives it very much the appearance of a cage. These means attain the object in view, but the result leaves much to be desired.

Stairs with a Single Central String-board without Well-hole.—This solution is rendered necessary when we are required to build a staircase with the utmost possible length of steps. The string-boards are superposed in the same plane in all the flights, one above the other, while the hand-rails run into each string-board of the next flight. These staircases are made in unbroken flights when the landings are not

Fig 17 Elevation

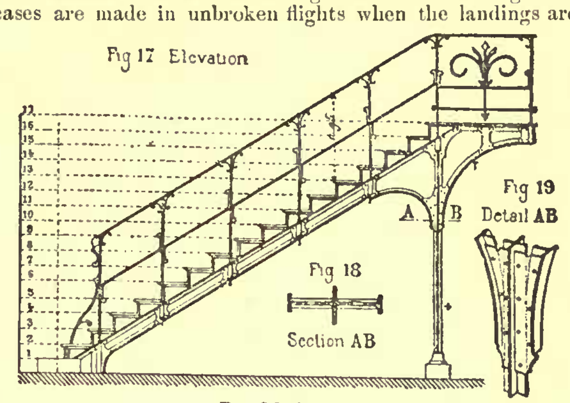
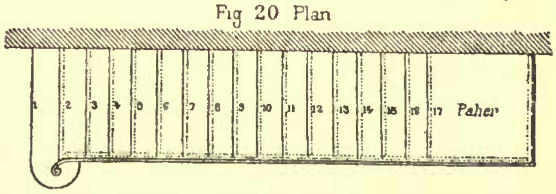


Fig 20 Plan



one above the other, and with intermediate resting-places if the landings are in superposition. These staircases are mainly employed in the construction of barracks, colleges, etc.

Stairs broken into Landings (Figs. 15 to 22). — These are composed of straight portions according to the walls of the cage, and separated by resting-places (Fig. 22) either at the angles or for intermediate places of access. Figures 14 and 15 represent a servant's staircase, 85 centimetres wide, which presents a combination of the broken and the winding stairs.

Semi-circular Staircases. — These are most frequently found in warehouses and small private dwellings. They are contained in a rectangular cage in a hemicycle. The step varies from 1 metre to 1 metre and 30 centimetres in length, and the well-hole measures 35 to 80 centimetres. As a minimum of dimensions, we may refer to a staircase in a house for letting, built according to the following measurements:

Width of cage	2 metres,	30 centim.
Length of cage	3 "	30 "
Breadth of tread (foothold)	0 "	23 "
Length of tread	1 "	2 "

The height of the steps is 17 centimetres on the ground-floor and 16 centimetres in the upper stories. The ground-floor is 3 metres and 40 centimetres high, and the upper stories 2 metres and 90 centimetres, measured from flooring to flooring. However, we say it again, these dimensions are hardly sufficient, and if adopted, it must be on compulsion to meet the exigencies of plans and of the configuration of the ground. If the well-hole be large enough, say 75 centimetres at the least, the steps may be balanced in a radius; that is to say, their prolongations may be made to converge towards the centre; but to render the transition from the head to the straight, three to six more winders may be introduced, according to the importance of a staircase, the remainder of the steps being parallel to one another. If, owing to the exiguity of the space reserved for the staircase, the well-hole be reduced to 35 centimetres measurement, all the steps must be dancing-steps or winders.

Staircase with Double Revolution.—The staircase with a double revolution, introduced in many buildings, be it square, rectangular, or round, has a central flight of large breadth, and two lateral flights of smaller dimensions, the relative proportion being as 1½ to 2. This type, in more restricted proportions, is employed in many important warehouses, and is well adapted both for a sober style of decoration and for elaborate ornamentation.

Horse-shoe Staircases.—This form is chiefly used for outside stairs. Regarded as an element for monumental structures, its effectiveness is very grand. The staircase in the Palace of Fontainebleau is a magnificent illustration of this type. If made of iron, it is specially suited for porticos with double balustrades. Columns or pillars used for stone staircases are replaced, when the staircase is made of iron, by columns and brackets ornamented to match the taste and style of the building itself for which the staircase is intended.

Fig 21

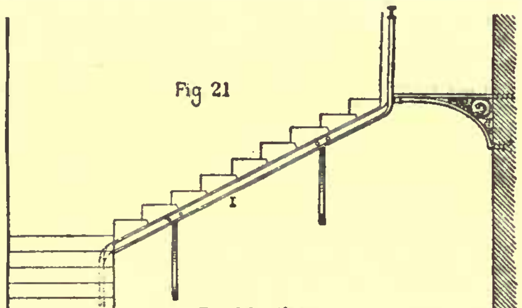
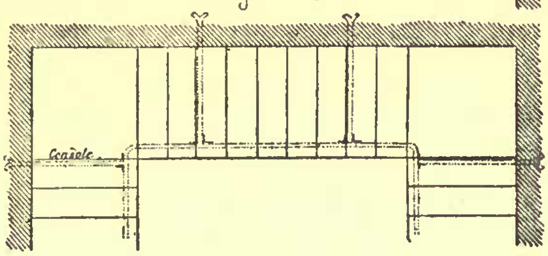


Fig 22 Plan

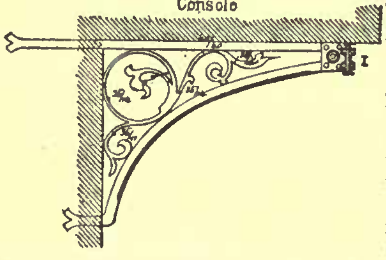


False String-boards—False string-boards are partial string-boards, fitted to the straight part of bays along the line of a staircase, and in such case they are provided with balusters and hand-rails along the width of said bays or recesses. As stated above, a false string-board may be made to run round the whole circumference of the cage.

Consolidation of a Stone Staircase (Figs. 21, 22, 23).—Consolidated staircases are built of volvic stone—a volcanic lava. The straight steps are simply framed into the wall, 10 centimetres deep. Brackets of 40 millimetre square iron carry a double T-iron of 100, that runs at 10 centimetres distance from the extremities of the steps.

Hand-rails.—The hand-rail of a staircase must never fall short of 90 centimetres in height in the landing, measured vertically from the nosing to the top of the hand-rail. The height commonly adopted varies from 90 centimetres to 1 metre. The distances between the balusters should measure 13 to 14 centimetres in the clear, or, say, 16 centimetres from centre to centre. In ornamental hand-rails made of wrought-iron, the openings, measured at the sides, should not fall short of 15 centimetres, particularly at the bottom. In schools, colleges, educational institutions, and generally in stairs used by children, it is customary to put knobs made of copper or any other metal at 1-metre intervals upon the hand-rails, so as to provide an obstacle to the indulgence of sliding down along the hand-rail. There is a question which, though foreign to the purpose of this article, would seem to merit attention on the part of builders. It is the incidence of lights on a baluster hand-rail. Let us suppose a burner fixed at *a* in Figure 13, the shadows would fall across the steps along the line *xy*. Steps polished with wax are apt to be confounded one with the other as we go downstairs, presenting but very slight differences in tone and shade, especially if the stair is built of fine-quality timber, and the consequence is that we are apt to mistake the shadow cast by the baluster for the limit of the tread, thus running the risk of taking a false step. This defective arrangement has come under our observation on many staircases, and we believe it can be avoided in a variety of ways. Thus, for instance, if the light be suspended beneath each of the landings, the lines of shadow will be very short, inter.ecting the step more diagonally.

Fig 23
Console



Method of Setting out String-boards (Fig. 16).—After chalking out the plan, settling the balancing of winders and dancing-steps, let the height of ascent be divided according to the number of steps arranged for, and number these divisions 1, 2, 3, 4, etc. Then, with a pair of compasses, or better still, with a steel tape, take the breadths of the treads at the straight of the string-board, similarly to be marked 1, 2, 3, etc. Carry these to the base line, raising them perpendicular to said line. The intersections of the lines bearing the same number will give the angles of each step. Then trace a pattern for a wooden or stone step, and with compasses opened to the extent of 13 to 15 centimetres, trace small arcs on the most advanced portion of the pattern, the tangential points of which, united between them, will form a broken line, which may be rendered more even by converting it into a continuous curve, which will be the under part of the string-board (Fig. 16).

THE EFFECT OF NOT TAMPING DRILL-HOLES.

THE *Engineering News* translates the following remarks of P. F. Chalon, in a late issue of *La Génie Civil*, giving the results of some experiments in abolishing tamping in drill-holes and the gain in rending effect resulting. He says he was led to these experiments by witnessing some tests of a new cap invented by M. Scola, in which the hole was simply closed by a wooden plug about 7 inches long. The plug was not tight, and permitted a considerable escape of gas, and a portion of the useful effect of the powder was expended in projecting the plug to a considerable distance.

The idea then occurred to him of simply plugging the whole with a handful of wet clay, which, in a manner, would hermetically seal it, and the resulting effect of the explosion "was enormous." He repeated the experiments a number of times and found that the dislocating effect of the black powder used under these conditions was much greater than when ordinary tamping was employed. A hole 6½ feet deep was charged with about 2 pounds of gunpowder and the hole closed with a clay plug about 5 inches long. The lines of least resistance in the rock measured 5.9 and 7.2 feet. The mass removed by the explosion equalled 27 cubic yards, or about "13½ cubic yards per pound of powder." (21 cu. m. per kilogramme of powder.) In a second experiment, with a hole 4.26 feet deep, 1.3 pounds of powder and a line of least resistance of 5.6 feet, there was no projection of the rock, but simply dislocation; that is, the best utilization of the explosive. The volume loosened equalled 16.67 cubic yards, or about 12.7 cubic yards per pound of explosive. A third experiment with 2.6 pounds of powder gave an effect of nearly 12 cubic yards per pound of powder. The mean of five experiments, including two charges fired simultaneously, was about 13 cubic yards per pound of powder used.

Under ordinary conditions of firing in the same quarry, 7.5 cubic yards per pound of powder was the result. Thus the new tamping, even at the low average figure of 9 cubic yards per pound of powder, amounts to a decided increase in effective result. The same results would probably follow from the use of any other substance than clay for hermetically sealing the mouth of the drill-hole, says M. Chalon.

The author says further, in explaining these remarkable results, that the explosion under mining conditions always produces three distinct effects:

1. The breaking of the base of the hole.
2. The dislocation of the sides.
3. Projection.

Each of these effects is more or less marked, according to conditions, and one may exceed in effect at the expense of the other two. The work of breaking is difficult to calculate, but Mr. Chalon thinks it is not less than 15 per cent of the total work. The work of projection of powder, in fire-arms, is about 14 per cent, and we can suppose that it is about the same for powder used in mining. The effect of projection is manifested in a special manner sometimes in mining, as when the explosion results in "a gun," to use a mining expression; that is, when the work is expended in blowing out the powder or in slightly enlarging the diameter of the bore-hole without breaking the rock. Generally the effect of projection is to displace the broken rock and throw it to a greater or less distance from the site of the explosion. This is practically work entirely lost, and equals about 30 per cent of the total work when the breakage is included.

On the other hand, when the charge is compressed under hard tamping and reduced in its normal volume, the powder has not time to burn completely, and a good part of it is dispersed without useful effect upon the rock. With mining-powder, in grains, the author estimates that 20 per cent in weight of the powder is thus wasted. Thus in each kilogramme, or 1,000 grammes of powder only 800 grammes do any effective work; and as the power lost in breaking and projecting equals 30 per cent of the total work, there remains as utilized only 800 x 70 = 56 per cent. That is, the useful effect of a kilogramme of powder, under tamping, represents not more than 56 per cent of the total theoretical work.

In now considering the case where the tamping is omitted, we have an air-chamber superimposed above the charge, permitting the powder to become thoroughly ignited and the gas developed to expand regularly and manifest its power throughout the whole extent of the sides. And the force of projection is also diminished, as can be proven by the relatively short distance to which a wooden plug embedded in the clay would be thrown. The loss from unburned powder is less, as shown by the light smoke and the disappearance of this immediately after the explosion. Taken the figures first given, it will be seen that without tamping the useful effect of the explosive is about 76 per cent in place of 56 per cent of the total theoretical work.

M. Chalon sums up the advantages of the omission of hard tamping as follows:

1. Economy in hand-labor.
2. Economy in material, as the powder is utilized better.
3. Better rending effect.
4. The suppression of the accidents so often resulting from tamping.

In his experiments the charge was placed at the bottom of the hole under the usual conditions, connected with a fuze or electric conductors, and the mouth of the drill-hole was then sealed by a clay plug 5 or 6 inches long. It is essential that this plug is fitted tightly, leaving no fissures for the escape of gas before combustion is complete. In place of clay, cement or plaster-of-Paris might be used.

SIMPLE METHOD OF TRACING THE JOINTS IN ELLIPTIC ARCHES.

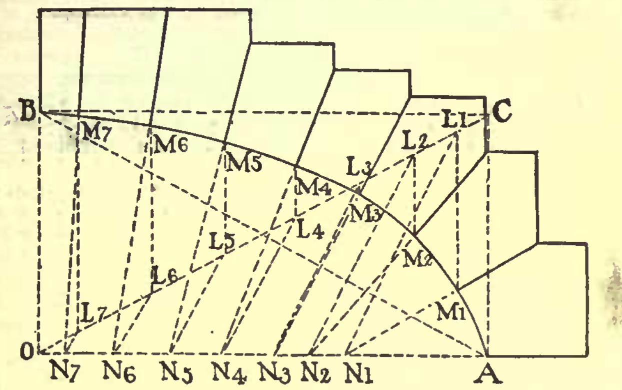


Fig. 1.

M. MAURICE D'OCAGNE, in *Les Annales des Ponts et Chaussées*, gives the following simple method of tracing the joints in elliptic arches: —

Let $m^1, m^2, m^3 \ldots m^7$ (Fig. 1) be points in the quarter ellipse $A\,B$, on which it is required to trace the joints normal with the ellipse. The tangents to the points A and B intersect at C; we then draw the lines $A\,B$ and $O\,C$. The perpendiculars to $O\,A$ dropped from $m^1, m^2 \ldots m^7$, cut the line $O\,C$, at the points $L^1, L^2, L^3 \ldots L^7$. The perpendiculars to $A\,B$, carried from the points L^1, L^2, etc., cut the line $O\,A$ at the points $N^1, N^2, N^3 \ldots N^7$. Then the lines $M^1\,N^1$, $M^2\,N^2$, etc., are the normals sought for.

The proof of this method is very simple. Let $M\,N$ (Fig. 2) be the normal to an ellipse at the point M. From the point N, we draw towards $A\,B$, the perpendicular $N\,L$, cutting the ordinate $M\,P$, at L. We now have, by a well-known property of the ellipse, the equation,

$$\frac{P\,N}{O\,P} = \frac{b^2}{a^2}$$

The triangles $P\,L\,N$ and $O\,A\,B$, having their sides perpendicular to each other, we have the equation,

$$\frac{P\,L}{P\,N} = \frac{a}{b}$$

Multiplying these together we have

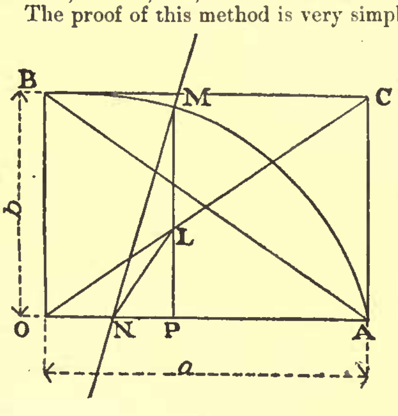


Fig. 2.

$$\frac{P\,L}{OP} = \frac{b}{a}$$

which demonstrates the fact that the point L must be located on the line $O\,C$.

COMMUNICATIONS

THE POINT OF GREATEST DEFLECTION.

LOUISVILLE, KY., September 30, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — In your issue of October 23, 1886 (No. 565), I find a letter of Mr. Fred. T. Slade, referring to the position of the point of greatest deflection; permit me to say that neither the statement in that letter nor the formula given for the deflection in the article on "Safe Building" (No. 562, October 2, 1886), are complete. We have:

1. If $m < n$:

Distance of point of greatest deflection from right-hand support

$$= \sqrt{\frac{n\,(l+m)}{3}} = \sqrt{\frac{l^2 - m^2}{3}}$$

Greatest deflection,

$$\delta = \frac{w.\,m.\,n.\,(l+m)}{9.\,l.\,e.\,i} \quad \sqrt{\frac{n\,(l+m)}{3}}$$

2. If $m > n$:

Distance of point of greatest deflection from left-hand support

$$\sqrt{\frac{m\,(l+n)}{3}} = \sqrt{\frac{l^2 - n^2}{3}}$$

Greatest deflection,

$$\delta = \frac{w.\,m.\,n.\,(l+n)}{9.\,l.\,e.\,i} \quad \sqrt{\frac{m\,(l+n)}{3}}$$

I wish to add another remark. The article on "Safe Building,' in No. 536 (April 3, 1886), gives "modulus of rupture — *Brechungs coefficient.*" This is a slight mistake, modulus of rupture is in German, "*Bruch coefficient;*" *Brechungs coefficient* means "index of refraction." Yours truly, CARL BOECKLEN.

THE RECOVERY OF PLANS FROM A CONTRACTOR.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — Please wire immediately cases of suits by architects for recovery or value of plans retained by contractors or others.

"HASTE."

[WE do not know of any successful suits by architects to recover plans The precedents are all the other way. The most noted case is that of Tolman *vs.* Phelps, "*District of Columbia Reports.*" Here Tolman, an architect, sued for recovery of plans from Phelps, who, as he thought, was misusing them, and took the law into his own hands by secreting the drawings. The result was that he was sent to jail for larceny, on a criminal complaint preferred by Phelps, and lost his own suit, the court awarding the ownership of the plans to Phelps. There have been several English cases between architect and owner, in all of which it has been held that the owner was entitled to keep plans made by his architect. Of course, he is bound to pay for the architect's services, but that is another matter. As between architects and contractors we do not know of any decisions. Perhaps the architect would do best to claim them through the owner, who, if he can demand them from the architect, is all the more entitled to compel the builder to give them up. — EDS. AMERICAN ARCHITECT.]

THE PROPER FEE FOR AN ARCHITECT COMPELLED TO ACT AS CONTRACTOR.

WYANDOTTE, KAS., 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — I am building a large private residence, and have made arrangements with the owner at five per cent commission for full services as architect.

Now, in the course of two months he is dissatisfied with the contractor and urges the architect to finish building the house by the day, the architect to hire the men, buy the material as cheap as possible, and, in fact, tend to everything so as to build it according to the plan and specifications; now I should like to know what commission the architect ought to have for full services and building the house?

[WE do not know that any rate of compensation has ever been settled for this sort of extra work on the part of the architect. As most of us know, it is not unusual for architects to be called upon to manage the completion of a building in just this way, and we imagine that it is the general practice to add to the regular commission a round sum which will fairly pay for the extra time necessarily spent in doing the work of a contractor. Some of us, perhaps, have grumbled a little to ourselves at the disparity between the fifteen or twenty per cent profit which the builder would expect as compensation for his services, and the modest charge which seemed to us all we should probably be able to collect for doing the same work, and we should be glad to know whether any of our readers have ever heard of a way of regulating the fee for additional service of the kind, which should be fair to both parties, and easily understood. — EDS. AMERICAN ARCHITECT.]

SOME INSTANCES OF DRY-ROT.

NEW YORK, N. Y., November 1, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — As the question of the best way to resist dry-rot in timber has again come up, by the discovery of the decayed condition of the floor joists in Holbrook-Hall in this city, it may be well to note an instance or two of a similar nature, as a warning which may be valuable in future constructions. In the case of the floors in the hall above referred to, they were constructed of 3 x 8 inch beams laid not only close together, but the joints between them were hermetically sealed by paper below and by a coating of hot resin or pitch on the upper side, closing the joints. This was no doubt the cause of the decay of the timber; as, if the beams were laid roughly together, with the joints open at top, there could have been an access of air, which would have sufficed for their preservation.

This deprivation of air has been proved in a great many cases to be the cause of the rotting of timber. Many years ago, the late R. M. Hoe, of the well-known firm of R. Hoe & Co., of this city, undertook to make the wooden posts and girders of a warehouse fireproof by coating them with plaster and cement; not long after, he discovered that they were rotting, and had it all stripped off. The case of the roof-trusses of the late Dr. Bellows's church in this city is another which fully illustrates this point. Evidence of settlement

at one end of one of the trusses caused an examination, which revealed the fact that the foot of the rafter and the end of the tie-beam were encased in a very large cast-iron shoe fitting tightly therein. Upon removing the timbers they were found to be half rotted off.

I was informed by the late John J. Serrell, the well-known surveyor of this city, that a floor laid by him in his house at Bayonne, N. J., was rotted by this cause. The floor was laid upon a concrete layer, or deafening, and covered with an oil-cloth in a hall-way. In walking over it he found that it gave way under his feet; taking his pocket-knife he found that he could run it through the boards anywhere with ease—except at the edge of the cloth, where the boards had not rotted, as there they had access to the air.

But if timber is immersed in water, only the surface decays for a short distance in, and the rest is preserved for hundreds of years. I have myself taken out timbers of an old dock, built in 1810, from filled-in ground and found it perfectly sound.

Yours truly, O. P. HATFIELD.

NOTES AND CLIPPINGS

CLOAK ROOMS IN CHURCHES.—Apropos of the structural defects of churches, which, I am glad to see, are attracting some attention just now, it is an astonishing thing that it has never occurred to any one to provide cloak-room accommodation at places of worship. I always feel a difficulty myself about going to church on wet Sundays, because I do not know how, when I get there, I shall dispose of my umbrella and macintosh with comfort to myself and without annoying others. No doubt many sensitive persons feel the same. Then, again, look at the hat difficulty. Few men can afford a new hat a week, yet no man can respect himself in a hat that has once been under the seat during a whole service. And how, I ask, can an average Christian perform his devotions in an acceptable spirit, with the knowledge that, as he kneels, he is putting his foot through the crown of his Lincoln and Bennett? I see that at the Church Congress the subject of "Hindrances to Devotion" is down for discussion, but I shall be much surprised if any reverend orator gives a thought to this aspect of the question. Yet I am convinced that a cloak-room, with a civil attendant to take charge of hats, umbrellas, etc., would do much to promote true piety, and would be a greater attraction than a sensational preacher—or even "church privileges."—*London Truth.*

A LIGHT TWELVE TIMES AS CHEAP AS GAS.—A very successful demonstration of its (lucigen's) great lighting powers was recently given at the Crystal Palace. The method of producing this light consists in forming an intimate mixture of air and minutely-divided oil particles, resulting, when ignited, in a continuous, steady flame of great brightness. The mechanism, which is very simple, is worked by a small supply of compressed air, and the flame is under perfect control by merely turning a tap. As the light is produced by the combustion of crude and waste oils, its cost is, by actual measurement by the official gas analyst for Glasgow, found to be from one-tenth to one-twelfth the cost of gas, and about one-twentieth that of electric light of the same actual candle-power. It is stated that an area of half a square mile can be flooded with light equal to daylight at an expenditure of one shilling and three pence per hour. The great value of this light lies in its diffusiveness, which adapts it so admirably for use on works or where any outdoor operations have to be carried on at night. A naked arc-lamp in a room is so blinding that work cannot be done; but when an opalescent globe is placed over it, so as to reduce the intensity, the eye sees details in the room much better, although the opalescent globe has cut of three-quarters of the light. The effect of the lucigen may be imagined, as it is said to produce a flame of 3,000 actual candle-power, or equal to six large arc-lamps, while its radiative-surface is about 350 square inches, as against one square inch for the arc-lamp. The result is that the lucigen gives a light of a quality highly effective for working purposes. The lucigen marks the latest advance in the history of the production of light from carbonaceous substances, as not only does it raise the carbon particles to the most intense white heat, but the form of the flame is such as to retain them in that condition for the longest period. The lucigen has been adopted at a large number of works in this country, including those of the Fourth Bridge, and it is also in use by the French Government for military operations.—*Iron.*

THE ANCIENT SEPULCHRAL RELIEFS AT ATHENS.—The unique series of ancient sepulchral reliefs which have been brought to light by excavations in the Cerameicus, the public cemetery of ancient Athens, have two interests, at any rate, which it would be hard to exaggerate. For one thing, many of them are extraordinarily beautiful; for another, they illustrate, as nothing else does, certain aspects of Athenian life and civilization at a period when Athens was still one of the great powers of Greece. Naturally, these reliefs are exceedingly various, both in date and workmanship and character. Some of them are archaic and stiff and formal. Others, again, easily distinguishable, are simply bits of bad work. But a large number are full of the most exquisite beauty and pathos, and it is chiefly of these that we wish to speak. In a great number of cases the artist has chosen for representation on these monuments the last farewells between the dying person and the survivors. Evidently, this was a very favorite form of sepulchral monument, and it admits of the expression of a far more delicate and a deeper pathos than any other form. There are reliefs representing the last farewells between husband and wife, between father and son, between mother and daughter, between friends. Sometimes the representation is allegorical. A lady takes her last look at her casket of jewels, which stand allegorically for the pleasant world to which she is saying farewell, and the relief is saved from all charge of triviality by the exquisite sadness of the lady's face. Of course, it must not be supposed that all the best reliefs represent these farewells. One of the most famous, erected to Dexileos, represents him as a victorious warrior in battle, slaying his foe. Still, what we have said is a true general description. Now, in order properly to appreciate the spirit of these grave monuments, we must remember that to the Greek death was necessarily far more terrible than it is to us. In the nature of things, he could have no "sure hope of a glorious resurrection." Whatever may have been the exact conception of death current among the average Athenians of, say the fourth century, B. C., we know that they considered it "the supreme evil." Very few people indeed could have been convinced by Socrates's famous argument to his friends after his trial that it must, after all, be reckoned to be a good thing. To the ancient Greeks it was not only a dreadful mystery, it was a final parting from all that they held dear, from their families, from their friends, from life itself. It still had all its bitterness. Nothing could have been keener than the grief which it excited.—*The Spectator.*

TRADE SURVEYS

A SLIGHT reaction seems to be setting in in manufacturing trade circles in the direction of higher prices. A month ago this was not even anticipated. The improvement may only be upon the surface. It is difficult to probe a matter of this kind to the bottom and furnish reasons one way or the other. The only apparent cause for the slight weakness in prices and the temporary dulness in demand for the past week or three weeks seems to have been brought about by the scare over the alleged stringency in the money market a few weeks ago. That scare having passed, confidence returned and orders began to drop in upon manufacturers and jobbers for merchandise and material of all kinds. The mills, factories, shops and mines of the country do not seem to be producing more goods and supplies than are wanted. For eighteen months past there has been no accumulation of goods, and no depression in prices in consequence of any accumulation. Nearly every manufacturing interest has been oversold for twelve months. The building interests have been crowded. The manufacturers of building material have had a profitable demand for their entire output, and even at this time, when the year's operations are drawing to a close, builders and manufacturers speak with a good deal of confidence of the prospects for the coming year. In New York City, Philadelphia, Chicago, St. Louis, Minneapolis, Omaha, and Kansas City reports have been received which confirm opinions recently expressed concerning favorable prospects of next year's building operations. Of course, opinions of this kind are tentative only and are based upon the fact that this year has been a good year, and that everything next year will be also as good. All the mill and shop capacity built this year has been engaged, and will be occupied as soon as ready for machinery, and the machinery will be run as soon as it is ready for steam. All of the houses built are now rented and a liberal percentage of them have been sold. The house-building authorities in New York and Philadelphia have recently given it as their opinion that the limit of building has not yet been reached, especially in the direction of moderate-sized houses. In Philadelphia builders have made purchases of land for the construction of as many houses next year as this. In such smaller cities as Pittsburgh, Cleveland, Toledo, Indianapolis and Springfield, O., a great industrial building activity has been maintained all the season, and as much building will be done during the winter months as the weather will allow. It is to be observed that vigorous building enterprises exists at manufacturing centres both North and South. Material of all kinds continues cheap, except brick. Slate, stone, lath, shingles, plaster, cement, glass, and the various fixtures which go into the interior of a house are all cheap, and no advance is probable because of more or less extensive preparations which those interests are now making to supply the improving demand. Railroad earnings for nine months on reporting railroads are of a character to stimulate construction. Clearing-house returns for the last weeks show a declining activity in trade. Iron and steel makers are turning out daily 21,000 tons of pig-iron and 7,000 tons of rolled-iron. Importations have reached, so far this year, over 1,100,000 tons of iron and steel material. Some authorities predict a depression in consequence. Iron-making is rapidly expanding. Forty wood-working machinery establishments have been put up during the past season. Boiler and engine makers are oversold to January 1. Ship-building contracts now in will keep yards busy most of next year, and boat-yards that will employ about 2,000 men will be in operation next spring. The anthracite-coal strike still continues, but as compared to last year the weekly deficit is not 30,000 tons. Last week's production was 740,000 tons as against 766,000 tons for same week last year. The total output reported is 27,700,000 tons, or 2,400,000 tons over last year. The lumber trade continues active and hardwood of all kinds is especially active and firm in price. White pine is moving freely. At Lake Superior points there are heavy stocks on stick, owing to high freights. Lumber has recently been advanced in several Western markets, but in the East there are sufficient stocks to keep prices uniform. Chicago dealers propose to tone up prices. Yellow pine receipts are heavy at North Atlantic ports. Sap is scarce at one or two points and is marked up fifty cents. Planing-mill supplies are low. The money market is well supplied and the business interests feel free from apprehension of stringency. The volume of money throughout the West and South is ample for all requirements, and frequently discounts are asked for prompt payments. The distribution of all kinds of merchandise is beyond precedent, and jobbers and retailers are in a joyful frame of mind over the favorable trade developments. Textile mills, shoe interests, clothing manufacturers, all speak of excellent spring prospects. Within a week car-builders have booked contracts for 5,000 cars, and there are orders for as many more held back. Nail-makers are still crowded to the wall. Plate-iron makers have, in some cases, spring orders booked. The coming year will be an active one for machinists and machinery-makers. Steam-power is urgently wanted, and the coming winter's work will be devoted to filling orders for spring erection. So far this year twenty-five hundred industrial enterprises have taken shape in the fourteen Southern States. This activity will not abate, as a great deal of railroad construction is projected for next year in the South and Southwest. Land speculation is not absorbing quite as much capital and it is safe to say that the well-understood dangers to be dreaded from ill-advised investment in that direction will prevent a ballooning of land values.

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CONTENTS

IN the death of Dr. Thomas U. Walter, the late President of the American Institute of Architects, the profession in this country may be said to have lost the last tie which connected it with the traditions of the Classic Revival, as well as a personal presence which had for sixty years steadily maintained the dignity of the calling which he practised, and influenced for good not only his professional brethren, but the sentiment of the general public toward our art. Thomas U. Walter, LL.D., was born in Philadelphia, September 4, 1804. He chose architecture as his profession at a very early age, and was placed as a pupil with William Strickland, perhaps the most distinguished American architect of his time. It is hardly necessary to say that in those days the taste of architects was formed wholly upon Classical models, the study of English Gothic being allowed, we might say, only in a limited degree to those who wished to devote themselves to the designing of ecclesiastical buildings. Young Walter, who was naturally of a sensitive, orderly character, delighted in the elegance and purity of the antique, and studied it with such zeal and success as to make himself probably the best Classical architect who has ever lived in this country, and one of the best in any country at the time when his professional career was at its height. When he began practice on his own account, in 1830, the range of professional employment was far more limited than it is at present; and it was only upon the rare occasions of the construction of a public building, or a great private mansion, that the skill of a regularly trained architect was brought into requisition. His first important opportunity came, therefore, with his appointment as architect of the Philadelphia County Prison, which was begun in 1831. Two years later, he won the first place in the competition for the Girard College buildings, the most costly group of structures which had at that time ever been projected in the United States, with the exception of the Capitol at Washington, and devoted many years to the task of carrying out his noble design, which even now is scarcely approached in dignity and interest by anything that has since been erected in the country. His success in this commission gave him a wide-spread reputation, and in 1851 he was appointed architect of the Capitol Extension at Washington. In this capacity he accomplished the very difficult task of converting the insignificant Capitol already existing into one of the most beautiful and imposing structures in the world. To our mind, in fact, there is no building in any country which approaches the Capitol. Many are more beautiful in detail, and there are some which would be improved in effect if they could be placed on the Capitol Hill, but there are plenty of examples to show that a poor design gains little by being displayed on top of an eminence, and with all allowance for circumstances, we have yet to see any architectural work which produces upon our mind an impression to be compared with that which the Capitol gives to one who sees it for the first time from near either of the railway stations, or from the Botanical Garden. The boldness with which this great work was designed and carried out shows, to the professional observer, the consummate skill of the architect, and his confidence in his own resources. Finding the old Capitol constructed of decaying sandstone, he had it painted white, and constructed the vast wings which form the extension of white marble, selected from a quarry which furnished a stone not only of extraordinary hardness and durability, but disposed to take on with age a delicious pearly color, which, as it shows itself at present in the long colonnades, gives them an effect of supernatural purity and beauty. The dome, which completed Mr. Walter's additions to the building, although of iron, is inferior to none in outline and proportion, and consorts better than any other that we know with the mass of building which it crowns. Much as we talk to-day, and with reason, about our progress in architecture, we have nothing to show more nobly simple and well studied than this great work, and it is no slight honor to the American aptitude for the greatest of arts that one the first of the important public buildings of the country should, by the nearly unanimous opinion of critics, be still unsurpassed by any structure of its class in the world. Besides the Capitol Extension, Mr. Walter, while in Washington, designed and executed the new front of the Treasury Department, the eastern and western wings of the Patent-Office, and the extension of the Post-Office, besides the Government Hospital for the Insane. On returning to Philadelphia, after the inauguration of the new plan of committing the public architecture to an official at a small salary, Dr. Walter was appointed Professor of Architecture at the Franklin Institute, and was soon after chosen to coöperate with Mr. McArthur in the construction of the immense Public Building of Philadelphia. In this, with other professional work, he was actively engaged almost to the time of his death, neither age nor infirmity sufficing to quench the ardor with which he followed his beloved art. In the profession he took from the first the highest rank, and on the death of Mr. Richard Upjohn, the first President of the American Institute of Architects, he was practically the only candidate considered for the vacant place. During his long term of office he was untiring in his efforts to promote the good of the Institute and the profession. Although the meetings of the Trustees were held in New York, nearly a hundred miles from his home, he rarely failed to be present; and his Annual Addresses at the Conventions of the Institute were models of their kind. Just before the last Convention, overcome at last by the weight of his eighty-three years, and the suffering incident to a serious infirmity, he sent word that he could not consent to accept a renomination as President, and a successor was chosen, with an affectionate reluctance on the part of the members of the Institute which will be deepened to sincere grief by the news of his death.

IT is gradually becoming evident that some stand must be taken against the abuse of power by labor organizations, if manufacturing industry is to continue. Already the dictation of Unions has destroyed the prosperity of one of the most flourishing iron-producing districts in England, so that the last furnace, out of more than a hundred which were once at work there, has recently been extinguished, and a similar result seems likely to follow the tactics adopted in many cases in this country. One of the most compact, as well as most tyrannical, organizations is that of the glass-workers. This has about seven thousand members, and includes all the operatives in every glass-working establishment in the United States. No one can be employed in any such establishment who does not belong to the Union, and the officers of the latter, by the simple method of coercion which consists in calling out all the men in a factory at a given signal, leaving the proprietors helpless, with their contracts to fulfil, have acquired an almost absolute control over the business. Of course, one of their first exercises of power has been in the fixing of a scale of wages, and these were at first arbitrarily fixed at such a rate that a good workman could earn something like fifteen dollars a day by blowing eighty dozen bottles. As usually happens, however, some of the members of the Union, who did not care to exert themselves, even for the sake of an increased income, and

who disliked to see those who did exert themselves getting more money than themselves, procured the passage of a rule, cutting down the production to the capacity of the poorest men, about sixty dozen bottles a day, and imposing heavy fines on any member who tried to better himself by doing more than this; so that now the skilful and observant men make their sixty dozen bottles in a few hours, and are compelled, under severe penalties, to spend the rest of the day in idleness, waiting for their clumsy and lazy fellows to catch up with them. As all the glass-working establishments are under the same code, the manufacturers do not suffer from the extravagant tariff of wages, but simply shift the burden on the consumers by increasing the cost of the goods; but the Unions do not stop there. Not long ago a manufacturer came to his business one day, and found the men idle. On inquiry he was informed that he was required to advance a certain workman a dollar. As he had paid the man his wages in full the day before, he could not see the propriety of a demand that he should advance him more before it was due; but the workman coolly explained to him that he owed the Union a dollar, and had no money left out of his week's wages, and that unless his employer advanced him the dollar, the factory would be struck. Of course there was nothing for it but to hand over the dollar, and work was then resumed. A few days ago some quarrel took place in a Western manufactory between the owners and the men, and the latter, as usual, resorted to their weapons, and gave notice that a strike would be ordered in thirty days. This time, however, the manufacturers resisted, and called upon the others in the trade to help them. The appeal met with a general response, the methods of the Unions being about the same in all the factories; and it has been voted, we are told, if the offending factory is struck at the appointed time, to close all the glass-blowing establishments in the country, and keep them closed until it shall be definitely determined who is to manage the business for the future.

ANOTHER similar struggle has been for some time going on between the brick manufacturers of New York and the Central Labor Union. The walking-delegates of the latter have, for some reason, declared a boycott against certain manufacturers, and not only have they stopped work in the latter's yards, but have engaged the teamsters, longshoremen, and barge hands to refuse to have anything to do with brick made by the offending parties. What the occasion of the quarrel was we do not know, but the other brick-makers of the city, after considering the case, have resolved to sustain their fellows, and have already contributed twenty-four thousand dollars toward the expense of doing so, and are now contemplating the establishment of a system of transportation of their own, independent of the present barge lines and teamsters' associations. Of course, the cost of doing so, and of all assessments and contributions made in aid of the boycotted firms will be added next year to the price of bricks, and will fall, in the shape of rent, upon the occupants of the tenements built with the bricks, many of whom will also, probably, have lost a considerable part of their income for the year, either in striking on their own account, or in contributions to sustain strikes somewhere else; so that the poor people, who live from hand to mouth, and cannot buy things when they are cheap, and keep them until they are dear, must, in the end, pay the whole expense.

WE mentioned a few weeks ago that experience had shown that mortar, made either with lime or cement, might be rendered much less susceptible to injury from frost by dissolving common salt in the water used for mixing the mortar. Since then we have seen an account of some recent experiments taken from the *Journal du Ceramiste*, which gives additional information on this very important subject. The experiments were made at Schandau in Saxony, and were suggested by the observation that mortar made with sea-water resisted frost better than that mixed with fresh water. In order to try whether water in which ordinary salt had been dissolved would answer the same purpose as the more complex sea-water, six samples of mortar were prepared. The first set, of three samples, consisted of clean river-sand, mixed with pure water for one sample, with water containing two per cent by weight of salt for the second, and eight per cent of salt for the third, and the proper quantity of hydraulic lime. The second set of samples was similar to the first, except that Portland cement was substituted for the hydraulic lime. A cube was made with each sample of mortar, about two and one-half inches on a side, and a square piece of tile was set on two sides of each cube, the mortar serving to cement the pieces of tile together. The samples were then exposed for three weeks to the weather, the thermometer during a portion of the time descending to sixteen degrees above zero of Fahrenheit, and were then brought into a warm room and kept for a week longer. At the end of this time each sample was tested. In general, the samples of cement were stronger than those of lime, but both the samples which had been mixed with pure water were disintegrated, crumbling away in the hand, and the bits of tile which they united were easily removed. The samples with two per cent of salt in the water were in much better condition. The mortar could not be crumbled with the hand, and, although one of the tiles could be forced off, the other still adhered to the block of mortar. The last two samples, made with water containing eight per cent of salt, presented a very considerable resistance. No impression could be made on the mortar without a hammer, and the tiles could not be separated either from each other or from the central mass of mortar, but broke away in pieces under tension, leaving fragments still clinging to the mortar. These experiments, simple as they are, seem to prove conclusively the value of salting the water in mortar for work to be laid in winter, and in our climate, where frosts come so suddenly and severely, the timely use of this ready means of defence against injury from them may be of great value.

ACCORDING to the accounts, a definite bargain has been made, by which the Trustees of the New York Episcopal Cathedral will come into possession, at the end of two years, of the plot of ground which had already been most favorably considered, just west of the Morningside Park, on the high plateau overlooking the Hudson River on one side and the Sound on the other. The estate purchased includes more than eleven acres of ground, and, at the price said to be paid for it, eight hundred and fifty thousand dollars, is very cheap for land so well situated in New York. As the cathedral building will hardly cover more than one-tenth of the ground, and the estate has a frontage on Morningside Park of seven hundred and thirty-five feet, so that the church will need only a comparatively narrow space at the sides to isolate it sufficiently, we suppose that it is intended to sell a portion of the estate, to which great additional value will be given by the building of the cathedral, and in this way raise a portion of the money required for construction.

MANY persons have probably had occasion to notice a change which takes place in Portland cement of certain kinds, which, when exposed for several years to the air, gradually loses its consistency and crumbles. So serious is this danger that the German Minister of Public Works issued in 1885, according to the *Schweizerische Bauzeitung*, a circular, restricting, within narrow limits, the use of Portland cement in work exposed to the air. Since that time, Professor Tetmajer, of the Federal Polytechnic School at Zurich, has devoted himself to investigating the matter, which he considered, with reason, to be of great importance to the building world, and has arrived at interesting results. According to him, the cause of the disintegration of cement exposed to air is to be found in a want of proper preparation of the materials, particularly in the lack of sufficient grinding together of the chalk and clay to ensure the complete silicification of the lime during the process of setting. When the imperfectly-mixed cement is used, the formation of crystalline silicates goes on around the semi-vitrified clay particles only, leaving portions of chalk in the condition of hydrate of lime. These portions lose their water by evaporation and by absorption of carbonic acid from the air; they are dissolved and disintegrated by rain and acid vapors, and leave the crystalline particles without cohesion among themselves. As the brands of cement which are liable to this sort of decay are not common, forming only about ten per cent of those tested by Professor Tetmajer, it is of importance to be able to distinguish them, and this may, as he says, be done by making a cake of the suspected cement, allowing it to set for twenty-four hours in a damp place, and then placing it in an oven maintained at a temperature of about two hundred and fifty degrees Fahrenheit. In the course of three or four hours the cakes of cement of a quality liable to crumble in air will become warped and more or less cracked, especially around the edge, while those which resist this test have been found without exception to be free from all tendency to crumble by prolonged exposure to air at ordinary temperatures.

THEATRE FIRES.[1] — REMEDIES.



IN a minor theatre in a small city in one of the Middle States, at a holiday performance of the "Streets of New York," the ambitions "property-man" had climbed into the flies with a pan of combustibles and fire-works to give due effect to the usual "fire scene." In his ardor to do the thing handsomely he grew careless through excitement and fired his whole stock of explosives at once. As might have been supposed, he was pretty badly burned and thrown senseless onto the stage below. By the greatest effort the flames were got under control, and the curtain fell amid the approving cheers of the audience, who little suspected they were applauding a realistic effect that came very near including themselves. The wounded hero of the hour was borne to the green-room, and under the influence of restoratives gradually regained consciousness. As his senses slowly came to him he looked feebly up at the sympathetic faces that bent over him and huskily murmured "*Was it a hit?*"

This anecdote is not only true but typical. One who has had no experience in the theatres can form no idea of the risks that are habitually taken to achieve popular success. The safety of actors, audience and building are all relegated to a secondary position when such is the objective. Incipient and often well-advanced fires are extinguished at frequent intervals, and come to be considered unavoidable. Two fires occurred in the Brooklyn Theatre shortly before the final deadly conflagration. One of them was of sufficient magnitude to start the spectators from their seats; and yet nothing was done to prevent a recurrence.

On "opening" and "first" nights and on holidays the insufficient force of stage-hands, as well as the actors, is overworked. All special precautions are forgotten or neglected. The auditorium is often unwarrantably crowded, especially in the upper tiers. All is bustle and excitement before and behind the curtain. At such times the only safety is in the cool exercise of control by an independent governing power, entirely apart from the general management, and acting with reasonable but absolute authority solely for the safety of the public. A corps of special police under the direction of the department for the inspection of buildings or of the fire-department might properly be charged with this duty.

If the present law is so revised as to compel every stage with all its paraphernalia to be made absolutely incombustible, the inspection would be a simple and easy matter; and would pertain chiefly to enforcing regulations against obstructions of exits and precautions against panics or rushes from any cause. In view of the acknowledged inventive genius of our nation it is absurd to consider such a result impracticable. To achieve it we must turn our backs on all foreign precedent. The question is not whether we can imitate the clumsy machinery in vogue in different materials, but whether we can produce all the needed effects and changes reasonably required, by methods entirely novel. It may be necessary to curtail and simplify the scenes somewhat at first, as is already done in many specially-constructed theatres on account of other limitations, but the gain will vastly overbalance the loss — especially if it should lead to the substitution of good acting for the meretricious effects of the machinist and scene-painter that are now made to do duty in its place. Some of the most successful theatres in use are small, with small stages, no sub-cellars and few traps or other accessories of the trick stage.

Although the degree of exemption from risk to be demanded must be determined finally by the people, if they do not elect to compel the full measure of absolute safety, it is next to be considered how to secure partial safety with the means available. For guidance in this as in the other case we must turn our backs on precedent. The supposed necessities of English and French custom have led to the peculiar form of theatre of which the prominent feature is a lofty auditorium with many tiers of boxes, necessitating a proscenium opening varying from a square to a height about once and a half its width. This, if filled by the scene, would necessitate a stage picture of awkward shape and great size. To lessen it, the upper section, sometimes to the extent of one-third, is commonly filled by a painted drapery. With a stage fully stocked with borders, and drops rolled up or tripped, and all their complication of light rigging, the first flames rise at once to the top, and in a few moments burst through the canvas screen and roll their volume of suffocating smoke out at the soffit of the high curtain arch and across the ceiling to the upper gallery, where the exits, being ordinarily at the highest point and near the ceiling, are choked almost before the people in the front seats and gallery ends can reach them.

There is not the least necessity for such extravagant height in American practice. The many tiers of boxes having long ago proved unprofitable, our managers have generally insisted on an open balcony and a second or sometimes a third gallery. The upper one is always very closely seated, to hold as many as possible on holidays, when anything in the shape of a seat or standing-place is saleable. Both galleries and balconies are deep, often having eight rows or more of seats. It thus frequently happens that, at the most dangerous time the upper gallery may contain five hundred or more people, and the whole building be crowded with double the number that should be allowed in it, and that are usually reckoned on in the provision of aisles and exits. A second gallery should never be allowed, except with such extreme provisions for safety as would make it an unattractive investment. Without it the form of proscenium opening could easily be modified to one of much greater safety — that is to say, lower and as wide or wider. A better stage picture can be set in a frame thirty feet wide and twenty feet high than in one with these dimensions reversed. The useless top drapery should be omitted altogether. Twenty to twenty-five feet high would give sufficient room to show two stories of cottage, house, or even palace; or shrubs, tree-trunks or lower branches in immediate foreground. Loftier structures, and full trees or forests can be set up the stage with as good or better results. Thus, with a low opening a large space would be available to hoist the fire-curtain and other curtains and all drops flat, without tripping or rolling — a very great convenience and saving of wear and tear, and a change that would greatly facilitate the work of the stage.

The lighting of the scenes might also be much improved, as border and foot lights would be brought nearer together; or for the latter, which are every way bad, an overhead front light could be substituted.

So radical a change in the proportions of the scene-opening would naturally lead to corresponding variations in the lines of the auditorium. It is not difficult to build, even after the present fashion, with such right lines that every seat in the house shall command a fair view of the stage for people of average height. The number of theatres, however, that can honestly claim as much is very small. But when it becomes necessary to provide for men and women of varying heights, and for all possible feminine extravagances of head-gear, the most skilled efforts lead to only indifferent results. A pitch is needed that shall include all eccentricities of stature and costume, and for this is required a rise of from one foot to eighteen inches in three feet, except in the few front rows which may even rise towards the stage. In fact, the pitch should not be a straight line, but in the form of what one writer calls an "isacoustic curve," or the curve of equal seeing and hearing. It must necessarily vary somewhat with the depth of seat-steps and other conditions. With so steep a pitch all the spectators would have a clear view, and no business of the piece and no temper would be lost in the unpleasant exercise of dodging the heads of one's neighbors. With the clear view would come equally clear hearing, and the depth of the house could be extended to the full limit of the actor's or singer's voice. One shallow gallery of three or four rows could be set low over the rear seats, if needed. The loss of room in an audience-room with these lines would be much less than at first appears, as the steep pitch of the seats would give room for ample lobbies and vestibules directly under the floor instead of in the rear of seating as now. Through numerous openings in the steep floor, the audience could promptly retreat in the opposite direction to the natural advance of flame and smoke. In such a plan we have simply a modification of the ancient amphitheatre, roofed in and otherwise remodelled for modern use. Such a form was suggested by the writer in your pages in one of a series of articles on theatres in 1879, and something similar in the seating arrangement by another in an illustrated article of January 13, 1877. The Wagner theatre at Bayreuth has somewhat the same form of seats. Of late it has been reported that Mr. Henry Irving has commended the amphitheatre-seating as best for safety and convenience. To make the change fully successful, the modification of the pitch and the elimination of galleries must be combined with the change of curtain-opening.

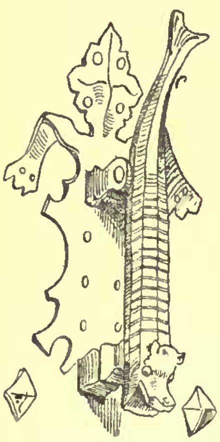
In any building the higher you carry people up the more difficult it is to bring them down safely. Some sacrifices must be made and expense incurred to remedy existing dangers in our theatres. Is it not better to take the natural and common-sense course at the loss of a little seating-room, but with the gain of much convenience, rather than at as great expense try to forcibly adapt an antiquated system to the changed conditions and needs of the present?

Such radical reforms as have been proposed apply strictly to new theatres. The exact form of such structures cannot be prescribed by law, perhaps, but the law can enforce every essential condition of safety. The present Boston building-act, although all in the right direction, is found, when viewed in the light of late experience, to require additional provisions and greater stringency. At least three sides of every theatre should be "exposed on streets or open passageways fifteen feet or more in width," instead of one side, as at present.

[1] *Erratum.* In fourth paragraph, second column, page 192, for "invasion" read "evasion."

Gas for lighting should be prohibited. No exits should be allowed through other buildings. "Special exits" should not be reckoned in the legal allowances for exits. All lobby, stairway, entrance and dividing walls should be of solid brick masonry one foot or more thick. Oil lamps or candles in sufficient numbers and enclosed by glass should be kept lighted in all stairways, lobbies and passages of exit and in rear of auditorium. Second galleries should be prohibited. The sale of standing-room should be prohibited. A rigid system of inspection should be inaugurated, with heavy penalties for violations of the law. The existing theatres should be carefully and thoroughly surveyed by a competent board of disinterested experts. Where possible, sufficient changes should be ordered to render each building reasonably secure. Where such changes are not possible, or the owners decline to make them, the theatre should be at once closed to the public and its license revoked. In the meantime, those who wish to avoid the greater risks should attend the newer theatres and those lighted throughout by incandescent electric-lights. There is no more direct way to absolute safety in building than to render bad methods costly and unprofitable. J. A. F.

SPOTS UPON PLASTER CEILINGS.



OLD KNOCKER. AT B RCELONIA

DURING the summer I was called to inspect a building lately erected and to find the cause of discoloration of the ceilings. Particularly upon the ground floor there were constantly to be seen brown spots, and these were intensified in damp weather, and at the same time other spots would appear, which faded away as dry days returned. A few isolated spots could be found in other parts of the building, but most of them were concentrated in the one lower chamber. The building is constructed with floors of flat terra-cotta arches, the ceilings plastered directly upon them, and there is a layer of several inches of cement concrete above the terra-cotta work and upon which the board floors are laid.

A careful survey of the ventilation-flues, to trace possible leakage, failed to establish any relation with the spots. They were equally in the centre of the ceiling of the lower room and at the sides. In one case, a single spot was found in the entry of an upper story. The tiling above this one spot was removed, also the concrete, but there was no sign of any unusual condition; everything was dry, there was no disintegration of the cement, nor was the upper surface of the exposed terra-cotta block discolored. Evidently some local cause in the plastering or coloring was to be sought.

To this end I took a number of samples from a ceiling of both plastering and kalsomine in spotted places, and the same from clear portions adjoining. The plasterer who had done the work informed me that only the common lime-and-sand plaster had been used, and no hard-coat had been put on. The kalsomine had been applied directly to the second coat. This kalsomine was the ordinary one of Paris-white, chrome-yellow and umber, with a glue size — a yellow tone of brown. It had been worked on soon after the plaster was well dried.

Microscopic examination of the samples showed no cause for the stains. The deeper-colored kalsomine of the spots looked like the addition of more umber, though no greater proportion was really present. A chemical analysis of the plaster, however, furnished a clue.

	Lime.	Sand.
A light brown spot gave	62%	38%
A dark brown spot gave	70%	30%
A clear portion neighboring gave	51%	49%

Thus it appears that where the lime was in excess of the normal proportion between it and sand, the spots occurred, and the spots deepened in color with greater proportion of lime.

In pursuit of this idea, I sent a block of the terra-cotta similar to those used in the building to the plasterer, requesting him to put upon it two coats, as he had done in the work. Some kalsomine was sent me made as was that used in the building. Before applying it, I located some lime spots free from sand upon the plaster. To duplicate as nearly as possible the damp condition of the floors from the effects of the undried concrete, I filled the ducts of the terra-cotta block with damp sawdust and maintained it so. In a few days there appeared on the kalsomine surface brown spots, the counterparts of those in the building, wherever the lime spots in the underlying plaster occurred.

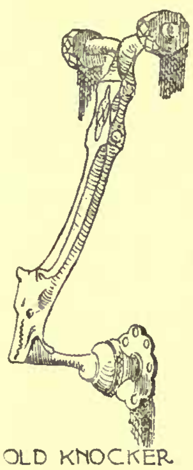
The reason of the formation of all the spots was undoubtedly the same: Small lumps of partially-slaked lime had acted upon the iron oxide (umber) of the kalsomine, and its color had been increased by the causticity of the lime, which, as it became further slaked by the moisture drawn through the porous terra-cotta from the concrete above, spread out the deepened color into a considerable spot. Probably one or two barrels of the lime used were not as well burned as usual, and, in tempering the plaster, small lumps of half-slaked lime escaped notice. In spreading this upon the ceilings, the trowel broke down such lumps, and they were partially mixed with the sand of the plaster in which they lay, but not enough to prevent analysis from showing a notable deficiency of sand and consequent good mixture of wet plaster, or enough to thoroughly slake the lime lumps. These lime spots are exceedingly persistent when fed by moisture from a concrete above, and once they appear, no ordinary work, like additional washes of color, or even a coat of oil paint, will obliterate them.

Two ways of obviating such occurrences suggest themselves. Presuming that lime plaster may not always be perfectly tempered, it would be well to postpone the kalsomining as long as possible, or, if this is not practicable, the safe course is to apply a hard-coat (plaster-of-Paris) before kalsomining. Where the expense of a hard-coat must be saved, the sure way to avoid spotting is to use only the best prompt-slaking lime for the plaster-work, leave it piled as long as may be, and double-temper it. Then there is fair reason to expect a good result. The thick layer of concrete used in construction of this kind dries much more slowly than the plaster, and furnishes moisture to it for so long a time that it is indispensable for good work to have the plastering in perfect condition if the ceilings are to be kalsomined at once they appear to be dry.

CHARLES TENNANT LEE.

SUGGESTIONS TOWARDS THE BEST AND SPEEDIEST METHODS FOR HARMONIZING AND UTILIZING ALL THE ARCHITECTURAL SOCIETIES IN THE UNITED STATES,[1]

SO AS TO SECURE THE MOST GOOD FOR ARCHITECTURE, FOR THE PUBLIC AND FOR THE PROFESSION IN AMERICA; DUE REGARD BEING HAD, AS CONCERNS MEANS, ALIKE TO INDIVIDUAL ENERGY AND ENTHUSIASM, AND TO ASSOCIATIVE EXPERIENCE; AND, AS CONCERNS ENDS, ALIKE TO LOCAL SENTIMENT AND TO NATIONAL REPUTATION.



OLD KNOCKER AT BEAUNE.

WITH so many architectural societies, filled with able men, there should be nothing too hard for us to do. But while there is good feelings between the different organizations, nothing requiring coöperation has been carried out by them. If all had the same definite views and steady purposes more would be accomplished, but until they have there will be wavering interests and semi-isolation, and, lacking the weight of authority, all important efforts will be like balls shot from a Roman candle, brilliant and well directed, but without power to penetrate. A few local bodies do accomplish something in a social way, also by reading papers and by specific discussions, but this is nearly all. To go much farther would need coöperation, which does not exist. Nor can national societies do much more than local ones, because they have no power to enforce their ordinances. And yet there is work to be done which, if not new, is very important to us all.

To exist, art needs sympathy, and to grow it needs that sort of criticism which ennobles both artist and critic. Therefore, kindly intercourse among architects is useful and should be cultivated; the more because social life both spurs to effort and helps one to keep a check upon his selfishness. A man, when tempted, may wrong his fellow, but is less likely to when both are of the same society, in which he must endure the reproachful looks and scorn of mutual friends. Members of any organization hate to fall below its average beliefs, no matter what its practice may be.

There is growing need for better training of draughtsmen than our practice now affords, yet there is little chance but in offices for most of these boys to learn. They need schools or lectures, or both; but having neither they fall far below their own possibilities. The work of changing this state of things should be ours. Where there are no technical schools we ought at least to establish some systematic method of training, perhaps by lecturing ourselves, no matter how slight or imperfect results may at first be obtained.

Since the schedule of fees was first printed our methods of work have improved. The amount of drawing alone then done on a given job in the best office would now be regarded as shamefully superficial in the poorest. It costs, not twice, but many times the sum it used to complete the office-work of any building. We are more thorough now, and should be paid in proportion.

Our efforts to throw open the Government work to the profession should continue, for the public surely has a right to the talent of its greatest architects, and the profession has a right to the work. Besides, it is a fact that public buildings badly designed depress and injure the artistic sense of the whole people, instead of inspiring to better taste, as good ones would. The national structures are the landmarks of our professional horizon; they are most prominent where most men are gathered together, and no one can help but see them. So for good or ill we are all profoundly affected by them.

Statutory revision is necessary, not by Congress alone, but by the legislatures of every State in which the practice of architecture is not already restricted to licensees possessing competent diplomas, or who have passed examinations before State boards.

But more important than anything yet attempted to be done by

[1] A paper read by D. H. Burnham, F.A.I.A., at the Twenty-first Annual Convention of the American Institute of Architects.

any society is the compiling and publishing of a code of ethics for architects, which, of course, shall show what is good, but especially what is professionably damnable in our dealings with each other. Let this be rendered in strong, clear type, and put upon the desk of every one, and it will at once have a most salutary effect upon the fee-cutting, back-biting, back-stair climbing crowd, and remove temptation from the lives of those yet uncorrupted.

To be sure, the above list does not present much that is fresh. Most of the subjects have been themes for discussion this many a day, but the truth remains that we have scored very few successes with them, and have made many failures. There has been too much energy wasted, and now we ought to try and weld our heterogeneous elements into a more effective whole. There has been no lack of material or effort, but our struggles have been scattering and uncertain, so that lately our meetings have commenced to be nerveless in many cases, with a growing apathy regarding matters of reform and a growing reliance upon good social times when we meet. In fact, some of the Chapters and Associations are practically dead, excepting for banqueting and the election of officers.

As a whole, the architectural societies have had plenty of time to show what they can do. But if measured by our hopes, or what we have expected, their work has not been satisfactory. We have strength enough, but it has not been brought to bear at the right place and time. No one can doubt that we have tried hard, but taking the entire record we have only won that kind of success most nearly akin to failure. And now three courses are left to us: to give up entirely, to go on as we are, or to re-organize. The first we cannot think of; the second we are dissatisfied with, and we must look to the last for the only chance to justify continued existence. If the latter way be chosen it is plain that some, if not all, of the old societies must dissolve and pass away. There have been too many, and their chief faults have possibly arisen from this. Since some must go, to avoid wounded pride or vanity would it not be better for all the old societies to give up their charters, and for the members to join together in a single new body, where shall be centered all their social activities, their art discussions and displays, their reform agitations, and finally their full authority. In this case there will be some hope for effective work on the lines of activity proper to architectural associations, and we shall have the chance to finish some of the many things we have commenced.

I do not know, in view of fresh organization, that there is to-day a single society or name to be kept, unless, perhaps, it be the title "American Institute of Architects," and this only because its dicta are the basis of so many court decisions in every State, and because its name and reputation are incorporated in the records of foreign societies. This question, however, is for some future committee to deal with. The matter of naming is of little consequence compared to what the constitution and by-laws shall be. If the name of the American Institute, or any other society, be retained, it must not mean that their organization shall be kept as it is to-day, it must be radically different. The present condition of things is as follows: We have many societies scattered through the country, whose members have the privilege of attending the annual conventions of either one or both the national gatherings. The change should not do away with the system of local societies, nor the valuable work they are capable of, for the localities in which they are established. But there should be a national controlling body in general things of practice, the members to be elected from the local ones. The annual meetings of an elected body would not be merely pleasant gatherings, no man feeling any particular responsibility; but earnest meetings of those best qualified to act, each one having a sense of responsibility, a clear purpose, and the obligation upon him to do hard work.

A small body of carefully selected men meeting annually for definite purposes, and entrusted with full authority, is what is needed. It is not in the scope of this paper to particularize much about it or its dependent societies, any more than to say that the first should act in matters applying to all architects throughout the country alike, and the latter in matters of social, artistic, and local work. How the local organizations should be formed, where and when the members of the controlling body should be elected, are matters for others to consider.

There should, and undoubtedly will be a memorial hall where may be gathered the portraits, busts, and mementos of our mighty dead, and in which shall be our national archives and library. The only place where this building can be erected without raising local feeling, is at Washington, and there it should be.

The office of representative at Washington should be difficult of attainment and of high honor. I believe the men should be elected for a long term, and that all elections in architectural societies, whether national or local, should be absolutely without nominations being previously made. Men ought to ballot without being prompted or checked by any committee or clique, and it should be cause for expulsion for any man to be found directly or indirectly soliciting office for himself, and there should be some penalty attached to his friends doing it for him. The judgment of a society is always best as to who is fitted to serve it, if the men are left to themselves.

A committee should be appointed by this meeting to act with another from the Western Association. These two should be empowered to meet and prepare a plan and recommendation to be submitted for consideration of both bodies in 1888. They should go into the matter of advisability of a complete new organization, and of how it could be brought about; of what in the main its form should be; how first elected; how the local bodies might come in and be used, and finally should give an outline of the constitution its work, and the chances for its being successful in the direction we shall want decisive action in.

MANUAL TRAINING AS APPLIED TO THE BUILDING ARTS.[1]



Gas Chandelier

STABILITY, utility, beauty—these are the attributes with which the architect seeks to endow the crude materials placed at his disposal—wood, stone, and iron. They lie in a confused mass at his feet, and he is to cause them to be fashioned, piece by piece, and assign to each its due place in the structure designed for the use of man.

Turning now toward the East, he passes in review the architectural triumphs of the ages—the Pyramids of Egypt, the temples of Greece and Rome, and the cathedrals of mediæval Europe. Inspired by the imposing retrospect, there rises before his eyes the vision of a building in which proportion, harmony and symmetry are happily blended. Fondly cherished, this child of the imagination, the shadow of a design, a filmy fancy, floats in the mind of the inventor, waiting to be transferred, a thing of beauty, to the solid earth. With an expression of rapture, he essays to speak, to describe the vision he sees, but the first word sinks away into a sigh of despair.

So it was ever from the beginning and ever shall be to the end, that imagination halts on the verge of performance, and speech fails at the critical moment, and it is always the hand that comes to the rescue of both.

It is only with the pencil in the trained hand and in a universal language—a language as plain to the Russian, the German, or the Frenchman as to the American—that the divine dream of genius can be rendered visible in lines, shades, angles and curves, to the gaze of an admiring world.

And so it is in every step of the builder's art. He who suggested that the branches of a tree be pulled downward and held by clods of earth to form a shelter, was the inventive spirit of the primitive man who shivered in the freezing blast. But he who seized the branch with his hands, and he who pinned it to the earth with a stone, these, not less than the other, made the rude house.

From the cave and the mud hut, which protected the race in its infancy, to the sumptuously-appointed city mansion of the present time, is a long progress, consisting of many steps, but these steps were not taken by the mind alone. It is only in the realms of mythology that the goddess, full-armed, is created by a thought. In real life, things of use and beauty spring only from thought and action combined. In the mind of an inventor, the machine is an idea, not a thing. It is the Midas-like touch of the hand that converts the idea into a locomotive, a steamship, or a cathedral. The steam-engine of Watts, Fulton and Stevenson existed dimly in the mind of Nero of Alexandria, but to develop Nero's thought required two thousand years of experiment.

So of architecture. There came a time—man having long since emerged from the savagery of the hut—when the designer of rude houses and temples, dreaming under the majestic arches and in the long-drawn aisles of the forest, saw, with prophetic ken, the sculptured splendors of the Parthenon, the vast unity of the Colosseum, and the symmetrical outlines of the dome of St. Peter's. How many thousand years were passed in reaching the dreamer's ideal is a secret of antiquity, destined to remain forever unrevealed. But of all the long progress not a step was taken without the aid of the hand.

From the first to the last operation in the builder's art, from foundation to turret of every edifice, from the first brick laid in the wall to the last touch of the painter's brush, the hand is the supple, cunning agent. It quarries and adjusts each stone in its place, fashions every timber, makes the mortar, carries the hod, wields the trowel, molds the glass, drives every nail.

These services are humble, but they are not mean; no service that is useful to man is ever mean. Plato's dogma—"all the useful arts are degrading"—is the most pernicious, as it is the most potent evil ever exerted upon the human race. It is in accordance with the eternal fitness of things that this dogma should have had its origin with a people who treated women with brutal contempt, assassinated infants, and taught their idle sons to hunt and wantonly slay peaceful slaves found toiling for their masters in the fields. But it is as strange as true that this dogma, shorn of its more repellent features, still controls, autocratically, all the colleges and universities and most

[1] A paper read by Charles Ham, at the Twenty-first Annual Convention of the American Institute of Architects.

of the public schools of the civilized world, and perverts, almost beyond redemption, the mind of every youth brought under its malign influence.

But the work of the hand is not confined to the coarser departments of art. It traced on paper the builder's initial thought — a thought too subtle and unsubstantial for expression in words; and of the mind it was the confidant and co-worker from the beginning, as it must be to the end, for the hand not only lays the foundation-stone, rounds the dome and points the spire, but adorns with splendor every part, enriching now with chisel, now with brush, overlaying all with a garniture whose design is not more chastely beautiful than finely wrought.

In the presence of the works of Phidias, of Michael Angelo, or of Meissonier, we are awed into reverential silence. We think of the products of the chisel and the brush as direct emanations of the brain. But Mr. Ruskin, with fine discrimination and insight, calls attention to the fact that "all the great early Italian masters of painting and sculpture began by being goldsmiths' apprentices, and that they felt themselves so indebted to and formed by the master craftsman, who had mainly *disciplined their fingers*, whether in work on gold or marble, that they practically considered him their father and took his name rather that their own." And Carlyle says: "Venerable to me is the hard hand, crooked, coarse, wherein, notwithstanding, lies a cunning virtue, indefeasibly royal, as of the sceptre of the planet. Venerable, too, is the rugged face, all weather-stained, besoiled, with its rude intelligence, for it is the face of a man living manlike."

The works of the sculptor and painter are not more direct emanations of the brain than are the humbler products of the toil of the craftsman. Both spring from that cunning virtue, "indefeasibly royal," that lies in the cultured hand. Both are essential to man's progress and both are equally honorable.

The decrees of the ancients, consigning the artisan to servitude, poverty and shame, and lifting the artist to the throne of kings, were brutally unjust. The term fine arts, as applied exclusively to painting and sculpture, is a misnomer. The useful arts are finer than the so-called fine arts. The latter are confined within narrow limits, while the scope of the former is co-extensive with the resources of nature.

There is more imagination, sentiment and humanity in a locomotive or a steamship than there is in the statues of Praxiteles, the paintings of Raphael or the works of Shakespeare. The relation between the useful and the so-called fine arts is undergoing a change — a transposition. The useful is about to take its rightful place in the order of excellence — the place too long usurped by the merely ornamental. In architecture, the true relation between use and beauty has always been observed to a far greater extent than in any other department of art, owing, doubtless, to the law of necessity, the natural law of Vitruvius — stability, utility, beauty. The essentials are in the order here set down; in the absence of the first two qualities, the last is vain. But even in an art so perfectly developed as architecture, there is in progress a radical change, and it is in the direction of greater utility. Thus the world moves always toward a higher appreciation of the useful arts. And this is a natural law, for the useful arts differentiate the civilized from the savage man. They are the true measure as well of moral as of mental progress, and every step in this direction confers a new dignity upon manual labor.

We are thus fast approaching an age and condition of things when Rousseau's anathema against idleness will be accepted as an imperative social law — "The man who earns not his subsistence, but eats the bread of idleness, is no better than a thief."

Manual labor, then, being the very soul of the builder's and of every other art, and the useful arts being the true measure of civilization, the co-education of the mind and the hand becomes the first duty of society or the State. And this is plainly the road to the solution of the labor problem. For it is idle to dispute the proposition: there *is* a conflict between labor and capital, and it will never be settled until it is settled according to the immutable laws of justice. The way to such a settlement lies through education — such a practical training of mind and hand as shall dignify labor by enlightening it, and so lead to such a system of co-operation as shall result in the fair distribution of all the fruits of labor, among those who contribute, manually or mentally, to their production. "Instead of the thorn shall come up the fig-tree, and instead of the briar shall come up the myrtle-tree. And they shall build houses and inhabit them; and they shall plant vineyards and eat the fruit of them. They shall not build and another inhabit; they shall not plant and another eat."

Sewage Destroyed by Burning It. — It is curious that just as we in London are spending scores of thousands of pounds in establishing a system of getting rid of our sewage by throwing it into the sea, the Parisians are seriously experimenting with a view to destroying their accumulation of sewage deposits by burning it. They seek to affect by fire what we intend to do by water. Before cremation can be generally applied to sewage matter, however, there must be a guaranty that the process of burning will generate no foul odors, and it is said that a recent invention enables the promoters of the new system to give that guaranty. The issue of the experiments should be closely watched by the long-suffering London rate-payers, for if burning is practicable it ought to be cheaper to carry out than the shipment of the solid sewage to some point well outside the Nore. — *London Figaro.*

The Illustrations

[*Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.*]

THE PARLIAMENT HOUSE, QUEBEC, CANADA. MM. P. GAUVREAU AND J. B. DEROME, ARCHITECTS, ASSISTED BY M. E. E. TACHÉ, COMMISSAIRE DES TERRES DE LA COURONNE.

[Gelatine Print, issued only with the Imperial Edition.]

SKETCH FOR HOUSE IN WASHINGTON FOR COL. JAMES F. DWIGHT, MR. H. EDWARDS-FICKEN, ARCHITECT, NEW YORK, N. Y.

This house will be built on the corner of Q Street and Connecticut Avenue, on a somewhat curiously-shaped lot. Taking advantage of this and the "parking" privileges that Washington allows, the rooms are designed in a freer manner than usual on an ordinary city lot. The basement story will be built of cobble-stones that have already seen service, and above the water-table of Baltimore brick and Lake Superior stone, with terra-cotta Spanish tiles on the roof. The balcony under eaves will be of oak.

THE CALDWELL HOTEL, BIRMINGHAM, ALA. MR. EDOUARD SIDEL, ARCHITECT, BIRMINGHAM, ALA.

The building is of stone, terra-cotta, and Philadelphia pressed brick, and will cost $250,000 without the furniture. It will give accommodation for 400 guests, and has all the modern improvements and conveniences.

The hotel is erected by the Caldwell Hotel Company — Dr. H. M. Caldwell, President, and one of the largest stockholders, and Joseph F. Johnston, Secretary and Treasurer. It will be completed by May, 1888.

REREDOS AND ALTAR FOR BETHESDA CHURCH, SARATOGA SPRINGS, N. Y. MR. A. PAGE BROWN, ARCHITECT, NEW YORK, N. Y.

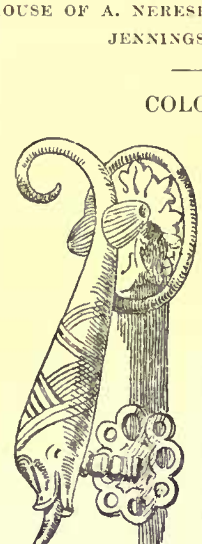
The reredos is of antique oak elaborately carved, with decorative panels representing the "Good Shepherd" and adoring angels. These decorations were painted by Mr. F. S. Lamb, who has recently returned from study on the Continent. The altar is of Echaillon marble with symbolism inlaid in mosaic. The work was executed by Messrs. J. & R. Lamb of New York.

COMPETITIVE DESIGN FOR THE OFFICES OF THE NEW YORK LIFE INSURANCE COMPANY, KANSAS CITY, MO. MESSRS. BABB, COOK & WILLARD, ARCHITECTS, NEW YORK, N. Y.

Our readers will remember that this design was submitted in a competition held in February last, and that the accepted design was published on April 9 last.

HOUSE OF A. NERESHEIMER, ESQ., NEW YORK, N. Y. MR. A. B. JENNINGS, ARCHITECT, NEW YORK, N. Y.

COLOR AND THE COLUMN.



OLD KNOCKER, SARAGOSSA SPAIN.

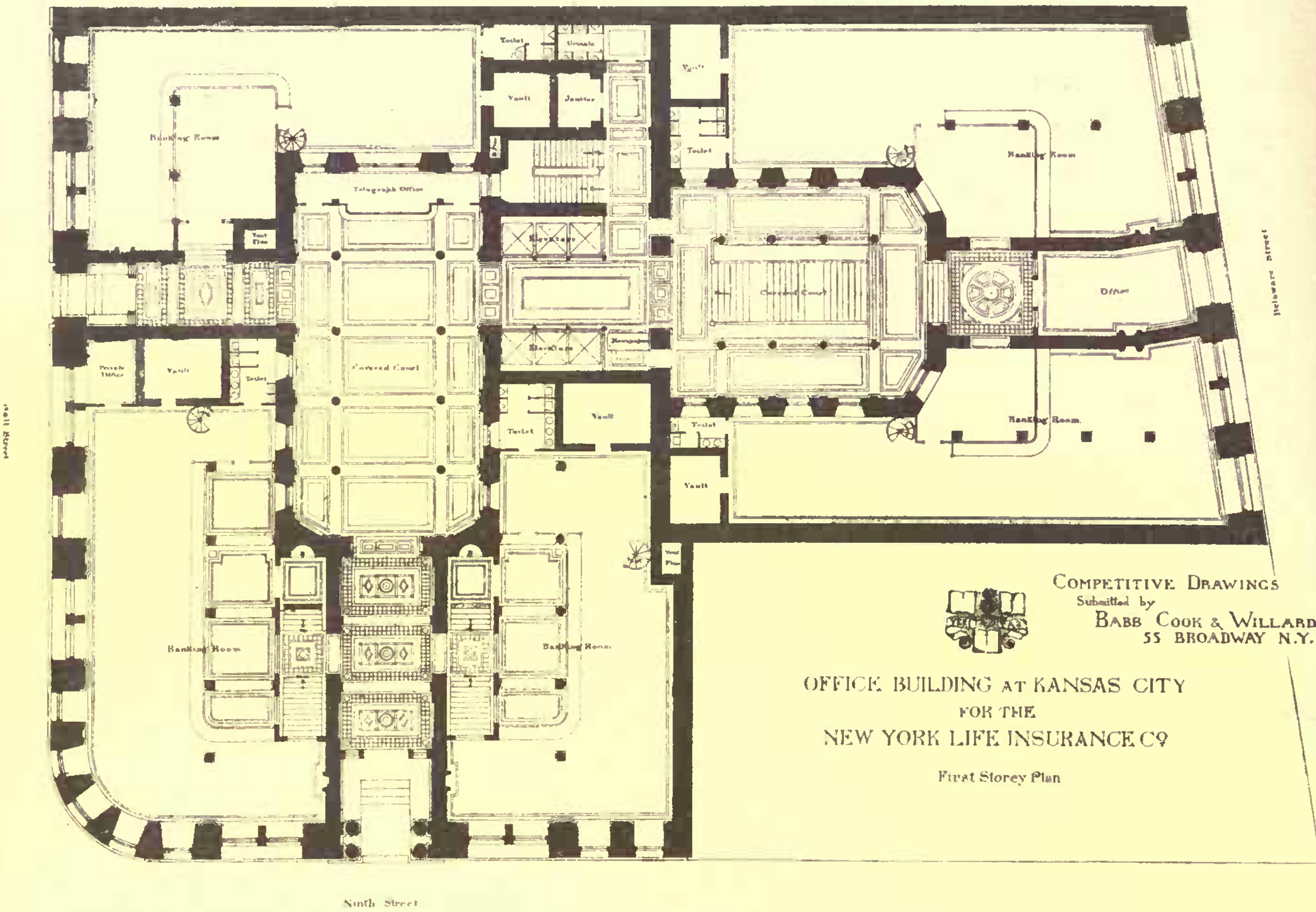
Whenever art addresses itself to realize in its work a certain degree of dignity — when it aspires to what may be worthily characterized as refined style, it concentrates its energies within some definite limits of the general scope of refined and elevated expression. This scope has infinite gradations between severity and grandeur in one direction and elegance at the other extremity. Intermediately is the place of that gracefulness which may verge to the decorative on one side and the majestic or the sublime on the other. Every original work of fine art is original and valuable to the extent that it gives force and emphasis to some special phase of these elements as they blend in novel and self-consistent proportions. So it is that the leading types of humanity have been taken as types of style. Vitruvius, in accordance with his system of cut-and-dried precepts, sets forth how the Greek columns were designed upon certain fixed patterns and those derived from the measurements of leading classes of the human figure. The Doric, he tells us, has the proportion, solidity and appropriate beauty of the manly figure; the Ionic column imitated the more slender form, the ornaments and attire of the matron; her hair above the forehead and her pendant curls were represented by the carvings of the mouldings and by the volutes, and the deep flutes of the shaft were architectural translations of the vertical folds of her raiment. Lastly, the type of the virgin's beauty



J. N. Delpierre, del. Edward Sidel, Architect.

THE CALDWELL HOTEL

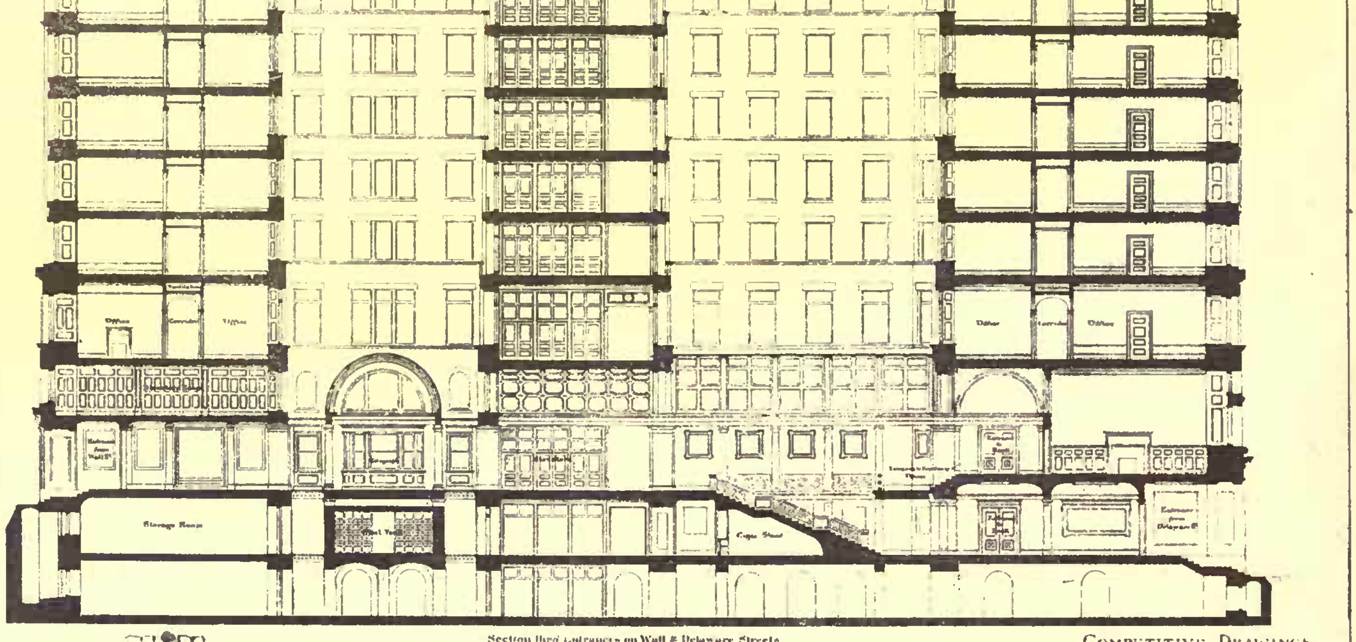
BIRMINGHAM – ALA.



Competitive Drawings
Submitted by
Babb Cook & Willard
55 Broadway N.Y.

OFFICE BUILDING at KANSAS CITY
FOR THE
NEW YORK LIFE INSURANCE Co.

First Storey Plan

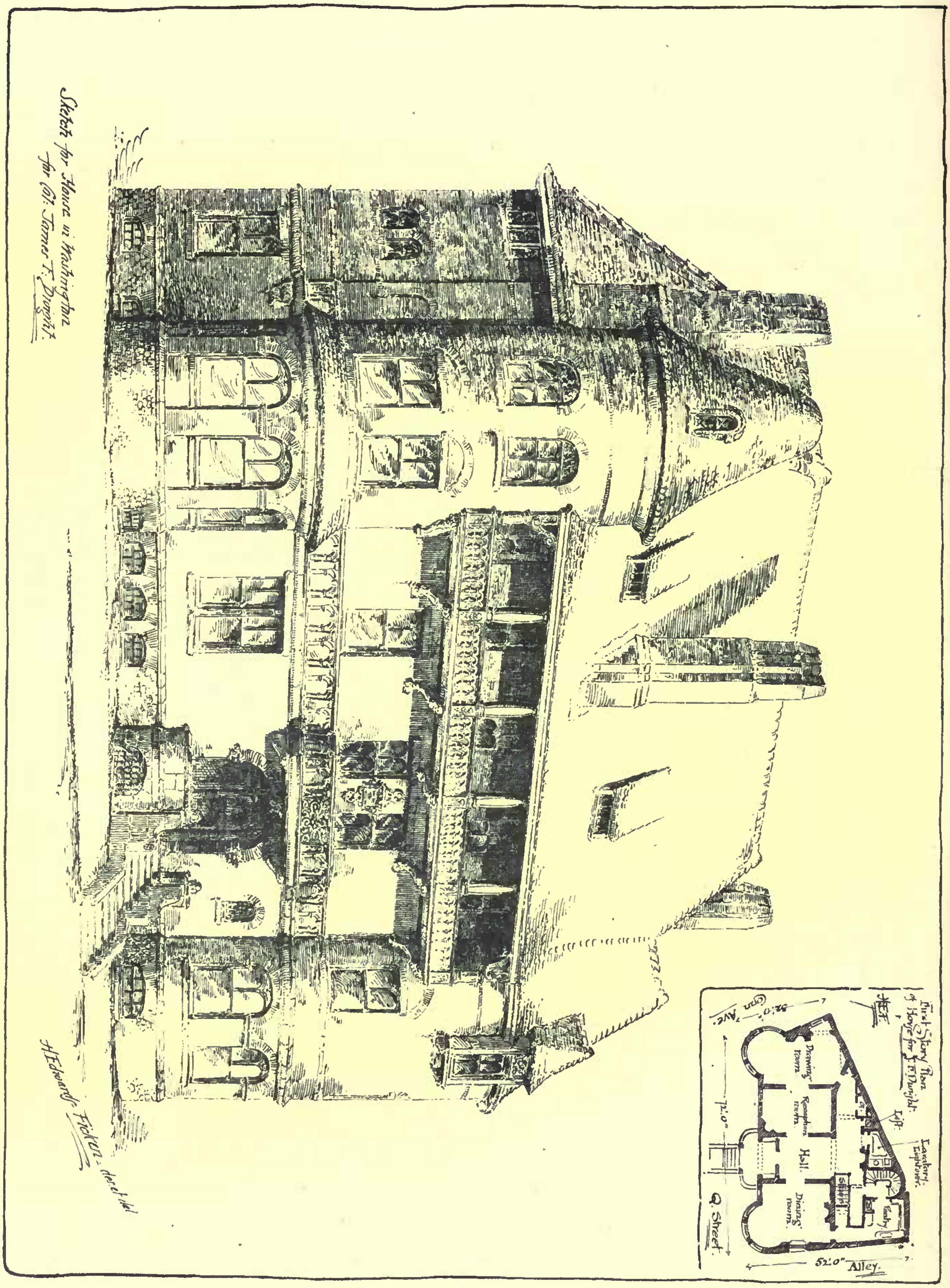


Section thro' Entrances on Wall & Delaware Streets
looking North

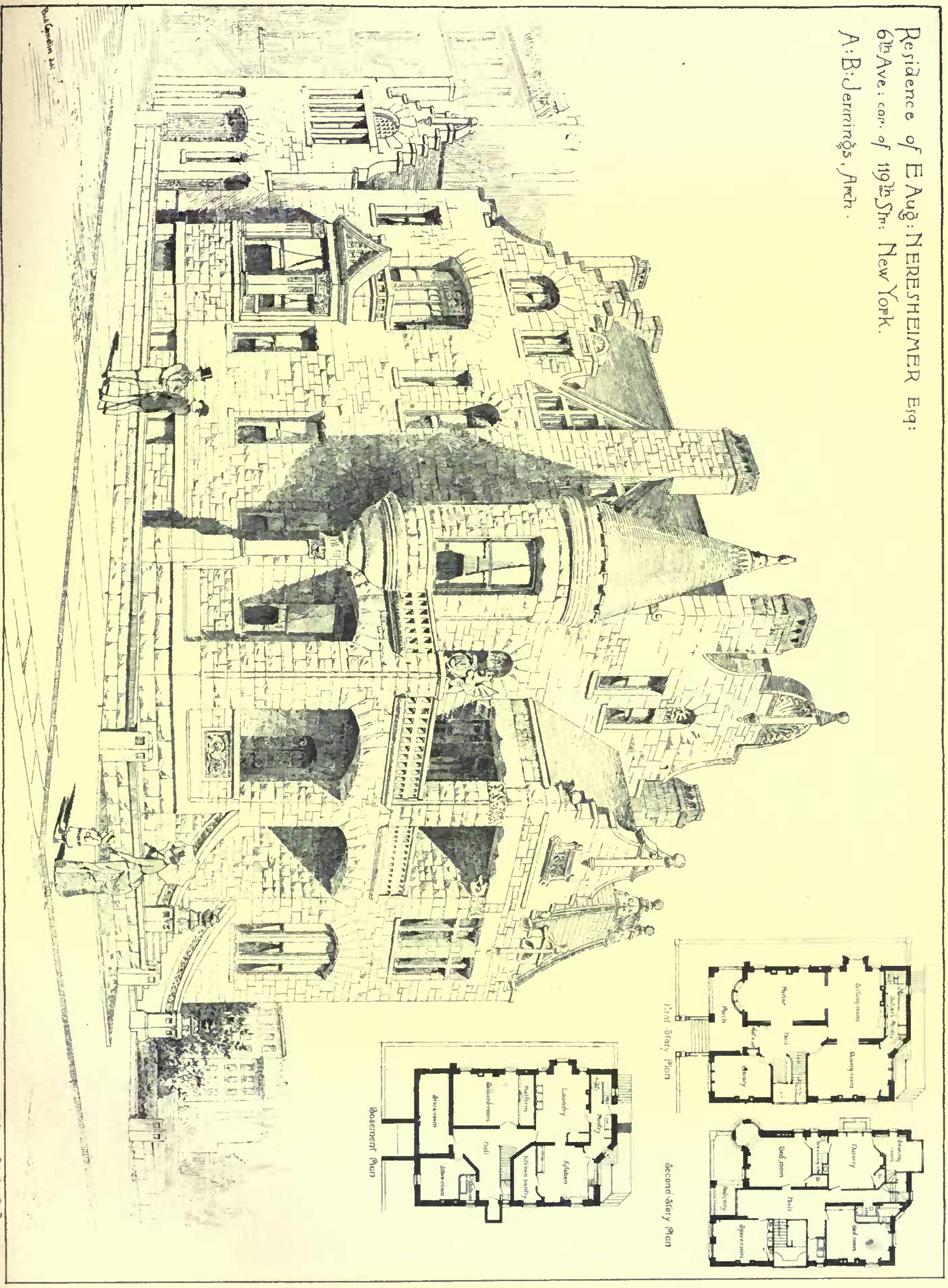
OFFICE BUILDING at KANSAS CITY for the NEW YORK LIFE INSURANCE Co.

Competitive Drawings
Submitted by
Babb Cook & Willard
55 Broadway N.Y.

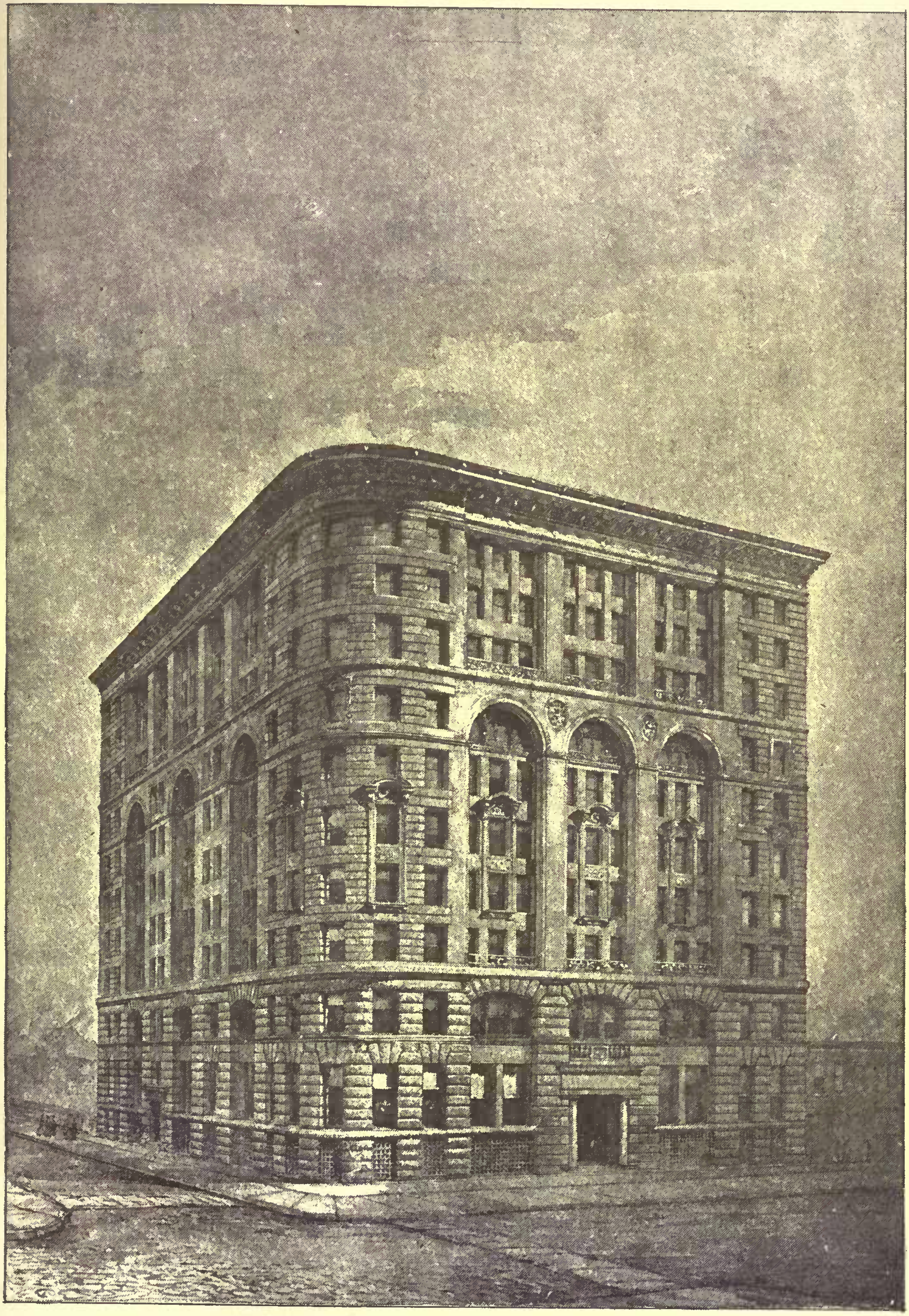
Heliotype Printing Co. Boston.



Heliotype Printing Co Boston.



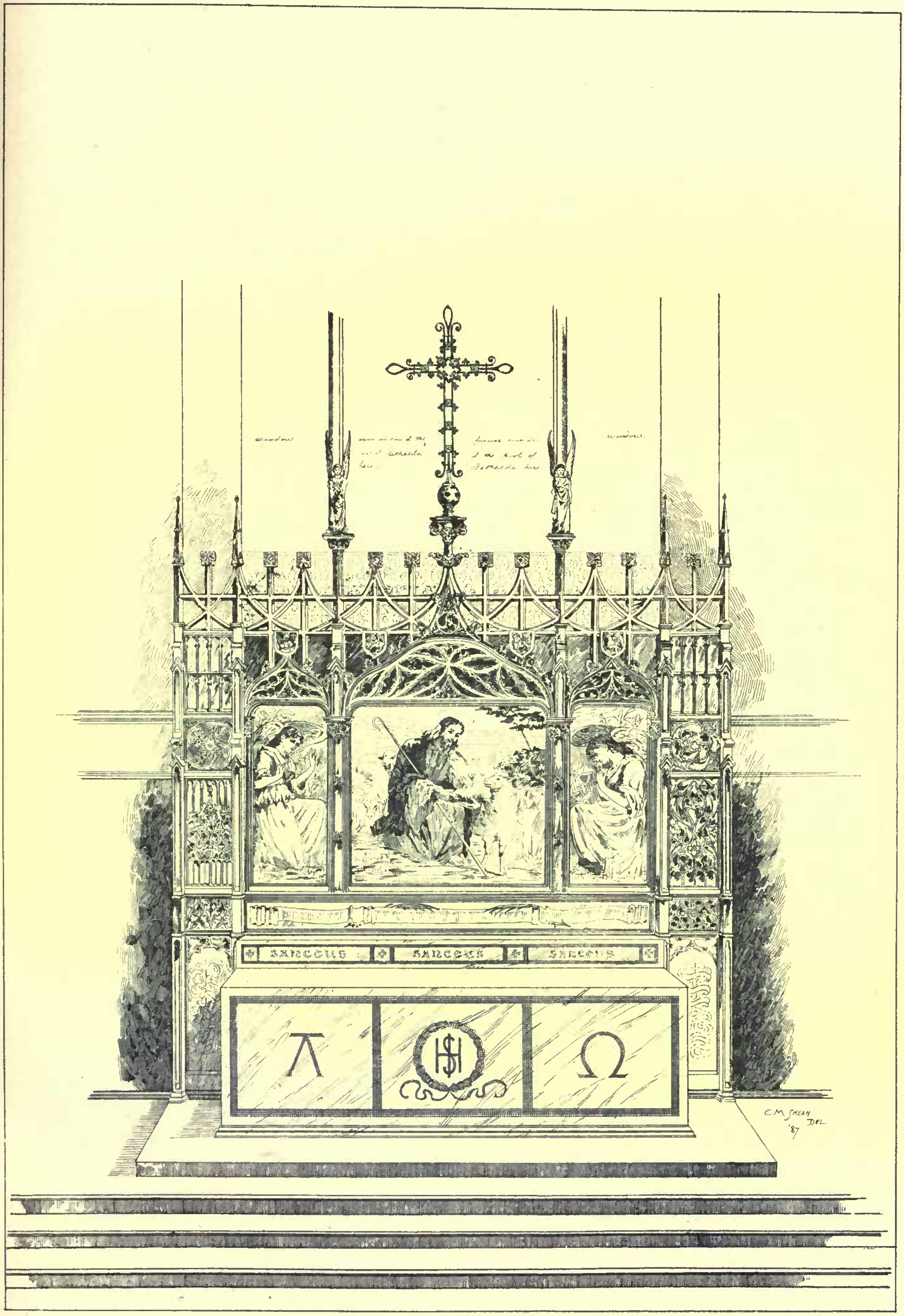
Heliotype Printing Co. Boston.



OFFICE BUILDING AT KANSAS CITY FOR THE NEW YORK LIFE INSURANCE Co.

COMPETITIVE DRAWINGS
Submitted by BABB COOK & WILLARD
55 BROADWAY N.Y.

Heliotype Printing Co. Boston



REREDOS and ALTAR for BETHESDA CHURCH
SARATOGA SPRINGS · N·Y·
A·PAGE BROWN · Arch't

Heliotype Printing Co. Boston

suggested a column still more slender than the Ionic, and a capital still more elaborately and delicately embellished.

In all this there is as much reasonableness as there would be in saying that Æschylus composed his tragedies on the model of men, Sophocles on that of women, and Euripides of girls; or that Shakespeare draughted Macbeth, the Merchant of Venice and Midsummer Night's Dream, upon similar principles.

All such theories are factitious and absurd; but they did not spring up independently of a root in a true analogy. The style of the Doric column may be justly called masculine, and when we meet with it in some of its debased forms, we are involuntarily prompted to characterize it as emasculated. The very same epithets by which we express admiration for feminine grace, rise to our lips when we become enthusiastic at the aspect of the Ionic porticos of the Erechtheum, as naturally as when we are contemplating the very figures of Attic virgins who are architecturally adapted on the southern side of the temple. Nor is it merely in general effect that we are influenced by these analogies. It is impossible not to feel in contemplating a Doric column, a certain sense of sympathy which depends upon the suggestion of those muscular sensations which we have in holding ourselves erect — of the pressure of our weight upon the foot; of the distinction which is claimed by the upper member of the human column, the head, as by the capital of the architectural column. It is in virtue of this analogy far more than from any functional propriety, that the capital of the column claims special elaboration. In the intercourse of man with man, the eyes are directed to meet the eyes, to regard the face of an interlocutor; the rest of the figure is left to a general impression, and so corresponds in effect, if not in specialized treatment, with the simple uniformity of the shaft.

Many of the general associations, therefore, which cling to the idea of the human figure, fly spontaneously to cluster about that of the column. In the capital, shaft and base of a Corinthian column, we in a manner unconsciously, that is, without direct recognition of the influence which we obey, are impressed by the general relations of the face, stature and feet of the human figure. So far the elaboration of the capital satisfies unacknowledged sensibilities, as answering to the presentation of the most delicate features, the most varied play of expression, the most refined outlines, the seal of culminant interest.

Quite as naturally and spontaneously do associations with the vegetating life around us transfer themselves to the column which — generally always — presents itself as a type of the plant life that rising — and rising with gradually decreasing girth from the solid ground, crowns the stem at last with "the bright consummate flower." Again in this cresting summit, we find the greatest variety and delicacy of form and outline, and then especially the enrichment of color in the most conspicuous display.

How far variety and brilliancy of color may be introduced with artistic advantage in the capital of a column, is not to be decided apart from the details of each particular case. But it is here that assuredly the analogies with general nature may be regarded and studied to right purpose. Nature is most lavish in the diversity of colors which she distributes to associated stalk, leaves and flower; but in no instance are we shocked by a discord. In consequence if we can only refrain from confusing generalities with particulars, there is no opportunity more instructive for the study of harmonious combinations of tints. A bed of nasturtiums in full bloom is at this moment in view. The petals vary from lightest yellow to deep scarlet, and the leaves and stalks connected with each variety — green as they are in every case — vary in each with a certain special and very positive conservation of harmony. The same applies to all the varieties of roses in a rose garden, each having its peculiar stain for leaf and stalk.

The moral of the lesson may be most effectively pointed by the indication of where and how architecture has been betrayed into an error and gone wrong in dealing with color. It is not necessary to refer to the buildings which supply the illustrations. Colored building materials, colored marbles especially offer great temptations — nay, let us say, offer fair inducements to attempts to snatch a grace which will relieve and enliven monotony of general tone. The old cathedral builders in England had their Purbeck marble, which they made use of for tall shaftings and secondary pillarets; and they rejoiced in its color, texture and polish without much thought as to how it would resist the affinities certain to be brought into close contact with it by condensed moisture. Very pleasing relief and graceful effects are obtained by clustered columns in this material; but still as it was introduced, a discord was brought in with it. We persuade ourselves to disregard this out of respect for the beauty around, in comparison with which it is but a trifling drawback. Still in frank honesty we must admit that a harshness there is in the sudden break between the dark and polished material of the ornamental features, and the cold, dull whiteness of the more solid and general structural masses.

The sentiment will be awakened that when so much has been done in the way of enrichment by color and polished surface more ought to have been done to sustain and justify it; if more could not be done because costliness was a difficulty, or from no other material of varied color and susceptible of ornamental treatment being available, then it seems that it would have been more consistent to apply such material as was at command less ostentatiously. The same observation is apt to be forced upon us not unfrequently at the present day. Among the beautiful materials which architecture has recently availed itself of with eagerness are various colored granites — as the ruddy Aberdeen and others, as well as marbles and porphyries. The quarries furnish monoliths of almost any required magnitude, and the temptation is naturally great to make them available for the shafts of columns, free or engaged, of very considerable size. But a mistake is committed in the first instance, whenever an appearance is allowed that so much reliance for effect has been placed upon either mere magnitude or the attractiveness of polish, grain and color that further studious refinement might be dispensed with. This is dismally the case when the shaft of what puts itself forward as the column of a Classic order is treated as simply cylindrical from bottom to top, or, at most, as the frustum of a tall cone, betrayed by the inclined lines of its profile as justly right lines. The very same unsatisfactory effect which the Greek precluded by the invention of entasis, that sense of unpleasant tightness or precariousness of direction appreciable by the eye, tells still with its original repulsiveness. This is aggravated by the observation that something which we have been accustomed to has been left out — left out, also, as it seems, from considerations of cheapness and economy of study and of labor — and these considerations are never more offensive because never more inconsistent than when stinted upon a material which in itself is lavishly expensive. Ovid says of the columns of the palace of the Sun, "The workmanship surpassed the material — "*materiem superabat opus!* This may be unnecessary, in some applications it is even absurd, but assuredly the richer the material is in any art, the more incumbent is it on the artist to show himself worthy of it, and not to efface himself as either content to rest claim for admiration on the crude material which he supplies, or to admit his inability to do it justice.

It is upon an identical principle that we recoil from another incongruity; this is when we find polished granite or marble shafts of columns surmounted by capitals carved out of an inferior material and on bases of the like. We have not far to go, at least in London, for striking examples of such anomalies. In some instances, this ill-mated material declares itself disastrously amenable to "skiey influences," splitting, exfoliating, disintegrating under frost, moisture and an urban sulphur-charged atmosphere. The contrast with the perennially durable shaft is the more gross because that architectural member which is to be more delicately carved and moulded has ever prefer ntial claim to a material which will preserve its surfaces and edges. And here we are brought back to the topic of the due relation of the capital of a column to its shaft in respect of elaboration and embellishment. What can be more properly styled an architectural solecism than a dead-white capital of any Greek or Roman order whatever upon a colored polished shaft? Yet nothing, it is sad to say, is more frequent within sweep of a not very extended radius upon a centre in St. James's Square. The capitals are of the same materials as the entablature, and the attic bases as the stylobate, and, in consequence, both from differences of color and material together, the shaft appears detached from its own complementary members, or, at best, has the air of an intrusive substitution.

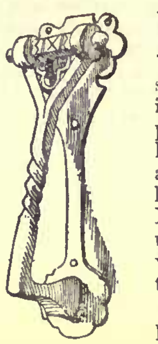
The re-discovery of the Numidian quarries so appreciated by the Romans has furnished very beautiful monolith shafts for the reconstructed hall of the National Gallery. The Corinthian capitals of these are of white marble. We may be w ll satisfied with the grace and delicacy of the carving, and may agree to pass the question whether this delicacy is quite so fairly treated as when it is supported by the delicate right-lined flutings of the shaft, which are omitted here. But what the capital which surmounts such a shaft most surely demands is a certain decision, nay, strength of color. Brass, if not gilding, bronze, at least, if not brass, would be a relief; it is even a question, considering the strength of the color of the monolith shaft — its strength and variety — whether details in colored enamel would not be admissable. The eye of the Ionic capital received such enrichment in antiquity, and a Corinthian capital, as more ornate, may claim such heightening tints with still more reason. So, again, in regard to the bases of the columns, we may in full consistency require if not brass or bronze, or marble which shall carry the appearance of solidity at least equal to that which it supports, and again affording a not inharmonious transition of color.

"But into what dangers would you lead us?" it may be objected. The argument as pursued so far would naturally lead on to demanding the application of color to the entablature. It is even so, and if the colored monolith shafts are ever to be so far harmonized as to blend into a consistent whole, the entablature also will require to be dealt with. When this has been attempted, the function of the critic may be resumed. In the meantime, one observation may be made in conclusion.

The architect who deals successfully with color will be endowed with the eye of an accomplished painter, and in any case he has to deal with light and shade, with cast and reflected shadows, as well as with perspective, outlines, sky-lines, profiles. It is as a picture that his work will at last, when executed, present itself to the world, and no picture is likely to excite admiration in which strong colors are unsupported and unrelieved by contrasts and gradations in proportionate distribution. W. Watkiss Lloyd.

The Passing-bell. — The idea that the sound of brass and iron has power to put spirits to flight prevailed in classical antiquity, from which it was, perhaps, inherited by Mediæval Christianity. This was the intention of the passing-bell. — *Chicago Living Church.*

PARIS GOSSIP.



OLD KNOCKER AT BARCELONIA

EVER since my last letter Paris has been empty and uninteresting. Everybody had gone to breathe the fresh air in the country or at the seaside. Now things are changed. Everybody is coming back, and life begins again. The Exposition des Arts Decoratifs at the Palais de l'Industrie, which had during the vacation season a melancholy air, has been quite animated for some little time. I did not mean to speak of it again, for I found there nothing really new. The real Museum of Decorative Art, open all through the year, with its pavilions thrown into communication with the present Exhibition, is alone interesting and artistic. The rest is only an agglomeration of all possible industrial products which are more or less connected with art. There is much furniture, and in general of an excessively complicated composition and in bad taste. It is quite time to return to more simple designs; but how many people think that the more colonnettes, balustrades, figures, consoles and garlands or other ornaments there are on the piece of furniture, the more artistic it is. I have seen people go into ecstasies over armchairs upon which it would be quite impossible to rest a head or an arm, so surcharged are they with sculpture. There are, however, some good things to be seen. All the returning Parisians make a visit to this Exhibition, which is the only thing of interest at the moment.

The theatres are opening with much advertising. Since the lamentable catastrophe at the Opéra Comique last May, all the managers decided to carry out the most indispensable of the alterations necessary to assure the security of the spectators; but since that time how ideas have already changed, and how largely Parisian carelessness and light-heartedness have recovered themselves. During the month which followed the disaster, Paris was like one overwhelmed. All the journals demanded prompt and severe measures to prevent the recurrence of such disasters. A commission was immediately named, which unfortunately exaggerated the ordinances by demanding impossible and useless things. What would have been sufficient was to cause the ordinance of the 16th of May, 1881, to be respected, with which no director had exactly complied. We have now in every theatre iron curtains, which are lowered several times during the evening. The free spaces have been enlarged, the doors open outwards, and finally the electric light replaces gas.

The same journals which after the burning of the Opéra Comique loudly demanded guaranties of security, now find that the commission is ridiculous, and bandy about witty sayings on the measures taken. The iron curtains especially excite their mockery. It seems to me, however, that this can be the most important aid and the most practicable means of preventing the auditorium being immediately invaded by smoke, which is the principal cause of death in all these disasters. It has been demonstrated that it was smoke at the Opéra Comique which asphyxiated the spectators and extinguished the lamps in the corridors, throwing everything into obscurity; so that eighteen persons, no longer being able to see their way, found themselves in the bar-room in the second story, where they perished by suffocation, although a staircase was within a yard of them.

Finally, each theatre in Paris now pretends to be the safest in case of fire, even the theatre of the Palais Royal, whose exterior, with its balconies at every story connected together by iron staircases, looks like a huge iron cage. These balconies, by the way, would be only useful on the condition, quite impossible in case of a panic, of not being seized on by the crowd. The staircases which connect one balcony with another are narrow, and can only give passage for a single person: far from being a safeguard, they will probably become a source of danger. This is evidently a very costly exaggeration of the Commission on Theatres, as was the suppression of the automatic rising seat of the orchestra chairs. This system, on the contrary, ought to have been insisted on in all theatres for the orchestra chairs and those in the balcony.

To pass to a subject quite different, I will say a few words of the fine monument erected to the memory of M. A. Thiers, which was unveiled on the 3d of September, the tenth anniversary of his death. This structure, which Mlle. Dosnes, sister-in-law of M. Thiers, has erected, is placed in the cemetery of Père-la-Chaise at the right of the chapel. It occupies an area of one hundred and forty-five metres, and has a façade nine metres in length and fourteen metres in height. The architect, M. Aldrophe, encountered great difficulties in consequence of the ground being a bed of clay, which obliged him to dig pits twenty-five or twenty-seven metres deep. The monument, very important in itself, is an assemblage of sufficiently commonplace motives, but the details are finely treated and well studied. It is composed of an archway, which forms the entrance, upon each side of which rise two Corinthian columns resting on a socle and bearing an entablature ornamented with modillions and dentils. The entablature supports an attic, which at the centre disengages itself, framing in a tablet of green porphyry, which bears this legend in gold letters, "*Patriam dilexit veritatem coluit.*" A flight of nine steps leads to the bronze door, which was executed by Barbédienne, and is crowned by a magnificent bit of sculpture by M. Chapu, which represents the Genius of Patriotism defending France. In the tympanum of the arch are two genii, which represent Science and Literature, which are due likewise to the same chisel. The lateral façades of the building are ornamented with Corinthian pilasters. Two arches with bronze grills serve to admit light to the interior. This, which I had not the good fortune to see, is, it appears, very rich, and decorated by the sculptor Mercié, with genii representing History, Eloquence, Science and Literature. Two bas-reliefs by M. Chapu, representing the liberation of the territory and the Genius of Immortality. There still remains to be set up a group five metres high. The tomb of M. Thiers is placed in the crypt, to which access is had by a staircase of thirty steps.

The Academy of Fine Arts on the 1st of October decided an important competition. The biennial prize of twelve hundred francs, founded by Madame Tryon in remembrance of her son, a famous landscape-painter, was the matter in question. The subject of the competition this year was "a water-trough at the edge of a wood at twilight." Forty-four artists took part in the competition.

Almost all the canvasses were interesting, showing much talent, but not answering very well to the requirements of the programme. In general, the skies were bad; the evening effect in most was entirely lacking. Some even presented mid-day effects in full sunlight. All the same, the decision seems to prove that the jury was influenced rather by the composition than by a strict interpretation of the programme. There ought to be some understanding in such a case. If the evening effect is not to be insisted upon, why say anything about it? "A watering-trough placed at the edge of a wood" would have been quite sufficient. A pupil of M. Paul Sain, M. Raymond Moisson, obtained the prize. M. Moisson added a village to his little wood. The painting is very agreeable, very well composed, and the wood required had more importance than the adjoining village, but the evening effect, where was it? I saw plainly enough an orange-colored cloud on the horizon, but that might as well be a morning effect. The trees are a little scant, not clearly enough massed, but confused. Aside from this, it had much atmosphere and light.

The first mention was accorded M. Louis Laurent, pupil of MM. Bin and Maignan. In this, the landscape is too elaborate; the evening effect is beautiful; the horses and cows in the foreground are not in their proper planes, but the background is pretty and very luminous.

I confess that I do not understand the second mention awarded to M. Lesidaner. His composition is careless and uninteresting. There is evidently an effect of the setting sunlight which one rarely sees. This is true enough, but something else than this was necessary to receive a mention. My opinion is that the judgment is a mistaken one, and I have been much pleased to see that this opinion is partaken by several of our masters of landscape.

One canvas was far above the rest. It answered the programme absolutely, was full of sentiment, and had a ravishing effect of twilight, and gave that sweet and melancholy impression which precedes the fall of night. It was the work of a pupil of MM. J. P. Laurens and Gobert, M. H. C. Renard, whom I have not the honor of knowing, but whom I take pleasure in naming, happy to be able to protest in his favor against the decision.

M. Brincourt.

REPAIRING ROOFS IN NEW MEXICO.

A CORRESPONDENT of one of the daily papers, writing from a point in the extreme Southwest, presents an interesting story of how roof-repairing is sometimes accomplished in that part of the world. While there is very little that is technical in what he says, there is much that is interesting, and it will serve to pass the time of noon hour during one of the hot days now prevailing; accordingly we print it in full, says the *Metal Worker:*

If the ceiling of any room becomes discolored with smoke or otherwise loses the white purity which must always distinguish the interior of "a room for rent," the same native has a remedy which is as effective as it is novel. He takes down the ceiling, puts it in the wash-tub, and after thoroughly cleansing it restores it to its proper position. As leaks in roofs necessarily have a close connection with room ceilings, I simultaneously gained my knowledge of both occult remedies during a rain storm the other night. When I came here I found that nine-tenths of the population lived in rented rooms, and that I must do likewise, unless I wanted to pay $17.50 per week for board. So I hired a spotlessly white room in a doby, and went to bed in one corner of it, without thinking for an instant that I would be inconvenienced by the heavy rain-storm prevailing. I changed my mind about midnight, when a stream of water worked its way through the mud roof and dropped squarely down on my head as I lay sleeping in bed. I got up at once and prosecuted a search for a match, while another stream played on my back. I lighted my lamp, and then saw about a dozen streams were coming through the ceiling. As my room opened on the road, after the manner of all Mexican dobies, I was compelled to dress myself, fish an umbrella out of my trunk, and go out into the storm to get into the next room, where my aged and Celtic landlady reposed.

"An' has that roof bruk loose agin? Well, now jest wait a brace o' minits till I get some clothes on, and I'll come to ye," she said, as she opened her door in response to my exasperated knocks. In four minutes she immerged into the storm, carrying two lamps, and rushed into my room. First she lighted all the lamps and put them around the room so as she could see well to do the work ahead. A glance

at the scene of action, a vigorous oath, and a plunge at the bed followed in quick succession. She put the foot-tub to catch the stream of water that was wetting the bed clothing, glared at me reproachfully, and then went to work. From the bottom of the wash-stand she brought forth a string and about three feet of an old broom-handle. These articles, it seems, are always kept ready for use in every doby house in New Mexico. Dragging the table to the centre of the room, my landlady put a chair on it and said, with business-like sharpness:

"Now, young man, 'spose you jest turn your back around entoirely." I faced about and the old lady scrambled to the table and thence to the chair. When I looked slyly over my shoulder she was bending a pin at right angles between her teeth. She then tied the string to the pin and reached up to the ceiling and stuck the pin in. I was startled to see the ceiling bulge downward, and then, for the first time, perceived that instead of being white plaster, as I had supposed, it was of white muslin. Having attached the pin so that it would not slip, the landlady leaped down with the other end of the string in her hand. To this end she fastened the piece of broom-handle and left it swaying gently before my eyes.

Heedless of my questions she seized a broom and went around the room gazing critically at the ceiling. Here and there were little blister-like protuberances, where the water had accumulated in little pockets. Each of these the woman pushed upward until the water ran toward the lower level around the point where the pin penetrated the muslin ceiling. The weight of the wooden stick on the end of the string, of course, pulled the muslin downward, making a hollow over the centre of the room large enough to accommodate all the little pockets. When the water had thus been accumulated in the central reservoir, I saw a small stream flowing from the end of the swaying broomstick.

"All the water will run down to the pin now, me dear, and thin down the string to the broom-handle, and thin down the broom-handle to this bucket, and thin you'll have no more trouble ef you'll jist keep away entoirely from against the bucket," announced the woman oracularly. It was even so. When she had put dry clothing on my bed and left me I turned in again and went so sleep in comfort under a roof that was full of holes. In the morning the bucket placed just under the pendant broom-handle was full of water, but the room was thoroughly dry. By daybreak it cleared up, and the woman's "man" was shoveling an extra cart-load of earth on the roof of my room.

"Now, Peter," I heard her call to him, "jist take and sow half a bushel o' grass-seed there, so that we will have a fresh sod before the next rain comes." Peter sowed the grass seed while Peter's wife took down the muslin which had been pasted around the edges of the ceiling. She took it away and washed it, and bringing it back soaking wet, pasted and tacked it into position. When I asked why it was not dried before being put up, she said it was desirable to have it wet, so that when it dried the shrinkage would make it taut. An enormous fire dried my ceiling until it was as white and smooth as the plaster of an Eastern domicile. The landlady put away the pin and string and bit of broom-handle in the bottom of my wash-stand, and said respectfully:

"Now, then, young man, if things spring a leak agin you 'tend to 'em yourself, an' don't come arter me. I allers show strangers how to stop a leak once, but I charges extra if they come arter me twict." In two weeks there was an elegant green sward on my roof. The roots of the rank grass form such a compact network that it takes a very heavy storm to wash away enough earth to admit water into the room underneath. For this reason I have escaped a second ducking, and have had no occasion to try my 'prentice hand with the pin and string.

THE INDIANA SOLDIERS' AND SAILORS' MONUMENT.

OFFICE OF THE BOARD OF COMMISSONERS OF THE STATE SOLDIERS' AND SAILORS' MONUMENT, INDIANAPOLIS, IND., November 1, 1887.

BULLETIN NO. 3.

TO COMPETITORS:

1. The Board of Commissioners, in answer to inquiries received, desire to state that no envelope disclosing the name of any designer in the competition for the State Soldiers' and Sailors' Monument design, will be opened till after a decision is reached, whether any design is premiated or not.

2. A competing firm writes: "We notice also that the code says: 'In any case the supervising architect shall be paid a commission of five per centum, etc.' We understand this refers to the architect whose design shall be premiated."

Answer, — The passage quoted refers to the author of the design selected, if it proves to be a design by an architect. The attention of competitors is again especially called to the paragraph beginning at the bottom of page 9, of the "Instructions, etc.," and continued on page 10, and relating to the appointment of supervising architect or sculptor.

3. A competitor writes: "I expect to submit to your commission a sculptural design and feel that any drawings of the subject would be weak and unsatisfactory. Is it permissible to submit models of statuary and bas-reliefs? And if not, will it be permissible to submit photographs of such models, sealed with sketch or design."

Answer, — It would not be permissible, since the Commissioners could not undertake the impossible task of making a fair comparison between a set of drawings and a set of models, or of photographs. The question now before the Commission is in regard to what shall be the general composition and design of the structure, and it is to solve this question they seek to obtain the sketches and suggestions of architects and sculptors alike. The sole object of the present competition is, as stated on the second page of the Instructions, to enable the Commission to determine the general character of the monument to be erected, and if possible to select an architect or sculptor. To permit photographs or models of statuary, bas-reliefs, etc., to be submitted in the competition would be confusing, and would only bring prematurely before the Commission exactly those questions of relative merits of details of statuary, etc., that the Commission wish at present to avoid. To decide upon those questions and merits will, as the Instructions expressly state, require the appointment of special experts, when the proper time comes, to select and decide upon those details. Even if a design should consist merely of a group of sculpture, what the Commission first wish to know about it, is its size, proportions, subject, and its relations to its pedestal and other accessories. It seems necessary also, to recall to competitors that the Commission will not in this competition receive tenders of contract or proposals to execute the work. Sculptor's estimates may be in such form as will seem best adapted to give an accurate idea to the experts, of the proper cost of the work according to their designs; but their estimates must conform to such figures as they will contract to execute the work for, under proper bonds.

4. An architectural firm writes: "You have already selected ten men in the profession to make designs; now if you can in any way assure us that we would have an even chance with these ten, and that the selection of the ten shall make no difference in the decision, we would like to submit a design."

Answer, — The Commissioners and the experts will not know, and do not wish to know, whom any design is by, before a decision is made. Should any competitor seek in any way to convey information to any Commissioner, or to any member of the Board of Experts, how to recognize that competitor's design, that design will be thrown out of the competition. The ten architects specially invited to furnish designs will stand exactly on an equal footing with all others in the competition.

5. The question has been asked, "How many names do you wish on the memorial tablets, etc."

Answer, — The Commissioners cannot answer questions such as this. Competitors are referred to the last paragraph on page 3, of the Instructions, by which it will be seen that the Commission cannot, now, entertain questions of the details of designs.

GEO. J. LANGSDALE, *President*.
J. F. GOOKINS, *Secretary*.

COMMUNICATIONS

MORE INSTANCES OF DRY-ROT.

BOSTON, November 5, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT:—

Dear Sirs, — The cases of dry-rot in timber submitted by Mr. Hatfield are interesting, but this danger may be incurred from a much less apparent cause than those which have yet been given.

My attention was first called to this danger in a mill building built by a corporation of which I was treasurer. It was in two sections, each intended to be leased. The first section was leased as soon as finished, and the heavy Southern pine beams were immediately painted. The second section stood for three years unfinished, even the floors not being laid. The beams belonging to the same lot as those used in the first section were thus left for three years *unpainted*. This second section was then leased in connection with the first. Some changes being called for, it was found that the beams in the first section were nearly all in a dangerous condition from so-called dry-rot. Nearly all had to be taken out. The beams in the second section, which had been left unpainted, were perfectly sound, and are in that mill to-day in good condition. This incident occurred more than twenty years ago.

Another example came under my own observation in another mill which was under my charge, but which was not constructed under my supervision. In this mill, the beams of the several stories butted together; a cap was placed underneath the beam to receive the top of the post below, and an iron base was placed on the floor above to receive the lower end of the next post. Thus the ends of all the beams were subjected to the full weight of the floors and their contents above. Under this compression the seasoning of the timbers was impaired, and after many years we discovered that so-called dry-rot had affected the ends while the middle parts of each timber were perfectly sound. This, again, rendered heavy repairs necessary. I know of many other similar cases in factories.

Within the past year I have gone through two large buildings, admirably constructed, with "factory floors," so-called; *i. e.*: heavy timbers set wide apart and plank floors. In one of these buildings the beams had been *varnished* and in the other they had been *painted*; both had been erected under the supervision of skilful architects,

but for lack of attention to this simple point they would have come to grief within three or four years had not the attention of the owners been called to the fault. The timbers were at once scraped free.

May I suggest that you procure and print again a scientific explanation of what is known as "dry-rot?"[1]

I understand it to be a fungoid growth, generated by the fermentation of one of the elements of timber while in a *moist* or green condition. It would, therefore, seem to be misnamed when called "*dry*-rot."

In the case mentioned by Mr. Hatfield of the posts and girders of the warehouse which had been covered with plaster and cement in order to make them fireproof the sinner was doubtless the *cement* and not the plaster.

In many cases we have advised the fireproofing of ceilings and timbers by the application of a rough plaster, without any skim-coat, laid on wire-lathing, a space being left in the walls around the ends of the timbers for the air to circulate. There is one example of this construction within a short distance of my office in which this protection has been upon the timber nearly twenty years. A few years since I requested the owners to uncover some parts of the timber in order to ascertain its condition. It was perfectly sound, thus proving that we were right in advising the use of rough plastering without any skim-coat of lime-putty and without any cement admixed therewith. The rough plastering being porous did not prevent the seasoning of the timbers. Yours very truly,

Edward Atkinson.

THE RECOVERY OF PLANS FROM A CONTRACTOR.

New York, November 5, 1887.

To the Editors of the American Architect: —

Dear Sirs, — We have read the inquiry of "Haste" and your reply upon the recovery of plans from a contractor, and would suggest that we have found the rule which we adopted several years ago as quite effective to that end.

We insert a clause in our contracts, requiring the contractor to return *all* drawings and specifications to us before our issuing the final certificate upon the contract for payment by the owner. We further require the contractor to sign receipts for any and all drawings and specifications given or sent to him, returning those receipts, signed by us, to him upon his delivering the plans, etc., at our office.

We have carried out this system for a number of years, and find it very successful, not only in securing the return of our plans, etc., but in keeping trace of them and proving their delivery in cases where assertions have been made that they had not been received by the contractors or other mechanics.

Very truly yours,
McKim, Mead & White.

A LAYMAN ON COMPETITIONS.

The following letters explain themselves. They are given *verbatim*, the names only of persons and places having been omitted.

"October 11, 1887.

"*Dear Sir*, — Our 'Society . . .' propose to erect in our city a monument to . . . We do not know exactly what we want, and wish the views of various artists and sculptors in competition for the honor of erecting it 'regardless of expense,' and Mr. —— has very kindly suggested that you could give me the names of various sculptors, etc., to whom I could write, inviting them to send us models and suggestions before the 15th November. Will you do so? If you can give us such names and addresses, it will greatly oblige the Society and especially, yours very truly, ———."

"October 13, 1887.

"*Dear Sir*, — Your favor of the 11th inst. is before me. I find it difficult to reply to it, and I must beg of you to believe me that what follows is not said with any sensation of pleasure, but solely from a conviction that it is right.

"Your letter is a sad instance of the lack of understanding of art, of the thoughtlessness concerning everything pertaining to it, that is, unfortunately, the rule among us. If the matter ended there, if we, having really no understanding of art, simply left it one side, utterly ignoring and neglecting it, there would not be much to say upon the subject. But no — we would *seem* to be what we are not, and there is where the wrong begins.

"I have neither the time to write, nor would you probably have the patience to read, a long dissertation on this fruitful theme. I must, therefore, content myself with calling your attention to one or two points.

"You are probably not aware that this question of competition is a burning one with all artists, not only here, but also in Europe, yet more so here than elsewhere. Much has been written upon it — the scandals caused by competitions are endless — the pain and the mortification that have grown out of them for true artists are grievous. The matter has come to such a pass that hardly a self-respecting man or woman will engage in an ordinary competition, and — pardon me for saying so — the one you propose seems to be of the *most* ordinary kind!

"Consider, in the first place, the time you propose to allow your competitors! Your letter is dated October 11, you have not yet announced your competition and found your competitors, and you want your 'models and suggestions before 15th November!' That would leave, say, three weeks at the utmost to evolve out of the mind, and put into tangible shape, a great work of art which is to carry the fame of the hero it is to glorify and of its author down to eternity! Have you truly considered this? Do not say that you ask *only for sketches*. In the first place, mere sketches will serve neither you nor the artists, for we laymen have a pronounced faculty for misunderstanding them. But this question aside, must not the sketch contain all the *intellectual* work that will make the monument great, leaving room only for possible refinements and the cunning of the hand? But as we are all, or most of us, workers for a profit only, we have lost the faculty of understanding the artist, who is cast in a different mould. Hence the work of art is for us no better than any other piece of manufactured goods that can be turned out to order at short notice, with perhaps this difference in its favor, that it is of a higher grade. But, what constitutes this difference we would be at a loss to define. Now here is the first point: The curse, or rather one of the curses, of our competitions is the insane haste in which the artists are asked to produce. If you gave them a year instead of a month, the time would be none too long.

"But, even supposing that you were willing to give the necessary time, the iniquities involved in your prospective proposal, as your letter discloses it, would still be far from being exhausted. What right have you to ask men to do work for you without compensation? Would you, as a lawyer, consent to outline the defence in a case at law, naming all your authorities and precedents, etc., in competition with half a dozen other lawyers, and then leave it to your client, who knows nothing of law, to decide? You would not do this, quite likely, even for money, and if any one were to ask you to do it at your own risk — have you thought what might possibly be the consequences? To be sure, you can fall back here upon the precedent of a thousand past competitions, but a thousand wrongs do not make one right; and, as I have told you before, artists are sick and tired of such attempts to fleece them. The consequence is that most of those who nowadays enter the lists under such conditions are either incompetents, or schemers who depend upon influence.

"To get through more quickly with the rest of this matter, let me ask a few questions:

"Where is your monument to stand?

"What amount can you positively promise to expend upon it?

"Who are to be the judges in this competition?

"You will answer that these are matters for future consideration, and that they are (with the exception of the third), as a rule, left open. True — and more's the pity. The result you see in the monuments about our cities, most of which are a laughing-stock or a source of mourning to all beholders, according to their individual frames of mind.

"You say your monument is to be put up 'regardless of expense.' I will take you at your word, and will show you how to lay out your money to good purpose. The first thing is not to begin wrong by being stingy at the least opportune time. Try, then, for once, to have a *decent* competition. To arrive at that much-to-be-wished-for result, it would be well to proceed as follows:

"Select four, five or six sculptors, the best, of course, you can think of, according to the lights you have, and *invite* them to compete.

"After consultation with these men, fix upon the sum each is to receive for his model, the pay, of course, to be alike, and the conditions of the models, also, to be alike.

"Likewise upon consultation with these men (or women), fix upon the place where your monument is to stand, and the sum to be expended upon it. Both these questions are vital, and the first no less than the second. It is ridiculous to design a monument without reference to its possible surroundings, and if we were not the barbarians we are, such a thing could not occur.

"Again, in consultation with your proposed competitors, select your jury. Artists will not submit, and ought not to be asked to submit, to the snap judgment of people who not only know and care nothing about art, but who do not even know what they themselves want.

"Now publish your scheme in all its details, and throw open your competition to all the sculptors of the country; that is to say, allow any one to send in models who chooses, under promise that, if any of the models so sent in should be chosen, the same compensation will be given for them (the models, however, to remain the property of the respective competitors) which is paid to the invited competitors.

"All this relates to the *first* competition. Now comes the *second* and final competition.

"Out of all the models sent in by invited and voluntary competitors, three are to be selected for the second competition.

"Give to the authors of these three models another year (or, at least, six months) in which to make their final models.

"From the three models resulting, select one for execution (provided, of course, that it comes within the money limit previously agreed upon).

"To the successful contributor award the contract and the control of the work.

"To the others give consolation-prizes of equal amount.

"If you carry out this plan, your association will make a name for itself, and will be honored as having been the first to reform the

[1] Such an explanation will be found in the *American Architect* for May 9, 1885.

abuses now prevalent in such matters. If it should be in my power to aid you in carrying it out, my services are at your command. Your plan as it now stands, I can have no hand in, not even by naming such poor devils of sculptors as might possibly be willing to submit to the indignities it involves.

"Pardon me for writing so freely. If you are really interested in art, and wish, in this special case, to assure a satisfactory result by honorable means, a few moments of consideration will convince you that I am right.

"Believe me, dear sir, very truly yours, ———."

As no response came to this letter, it may be assumed, that it produced no effect.

[THIS correspondence is the more interesting as it passed between laymen, though, as may be supposed, the respondent is one known as deeply versed in all that relates to art.—EDS. AMERICAN ARCHITECT.]

THE COMMISSION ON BUILT-IN MANTELS, ETC.

BRIDGEPORT, CT., Oct. 28, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT:—

Dear Sirs, — Will you kindly inform me whether the regular architectural commission of five per cent for residences includes the pay for designing and making working details for mantels, sideboards, built-in buffets, etc.?

By answering you will confer a favor upon SUBSCRIBER.

[THIS is a point about which there is much diversity in practice. Many architects charge the regular commission on the cost of the building alone, and ten per cent or more on the cost of the mantels and other fittings. Even in the case of the largest buildings, and for residences, unless very large, five per cent on the cost of building and fittings together cannot, certainly, be considered remunerative. EDS. AMERICAN ARCHITECT.]

GRAIN OF CHESTNUT DOORS.

NEW YORK, November 4, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT:—

Dear Sirs, — Can you tell me through your columns or otherwise, what will conceal the grain in a chestnut door which has been treated already with wood-filler, five coats of white-lead, two of zinc, and two of varnish? Yours truly, W. W. KENT.

[IF the door had been thoroughly rubbed down between coats with pumice stone, the grain would have been covered out of sight before half the number of coats actually applied had been laid on. — EDS. AMERICAN ARCHITECT.]

NOTES AND CLIPPINGS

NEWLY-FOUND CARTOONS BY RAPHAEL. — The Russian Professor Shevyreff, who is an authority in matters of art, and particularly known as a student of Raphael, has pronounced a number of cartoons recently discovered in a barn on the Lukhmanoff estate, near Moscow, to be genuine works of the great master. They are sketches for "The Healing of the Lame," "The Death of Ananias," etc., etc., and are said to have been intended for the Gobelins ordered by Leo X for the Vatican. They were bought in 1815 of the Countess Yaguzhinski, by one of the Lukhmanoffs, and have since been lost sight of. The cartoons have only slightly suffered from dampness, and will soon be exhibited in Moscow. — *Exchange.*

THE STATUE OF LIBERTY FOR SAN FRANCISCO. — The San Francisco Statue of Liberty will be by no means such a gigantic structure as that on Bedloe's Island, though its light will be shown from a greater height. The figure and pedestal will be about forty feet high, and it will stand on Mount Olympus, which is about 700 feet above the water. A two-inch gas-pipe passes up the entire height of the pedestal at the centre to the base of the figure, and through it the electric wires will be passed, making their exit at one side of the figure, passing thence along the folds of the robe up to the arm holding the torch. The light, which is expected will be supplied by the city, will be 16,000 candle-power, and will illuminate the entire Golden Gate Park, as well as being visible from the bay, a splendid view of which is commanded from the summit of the mount. The figure is the work of a Belgian artist named Wiertz. He named it "La Troimphe de la Lumière," and intended that it should represent light triumphing over darkness, liberty over tyranny and despotism. It was exhibited at an exhibition in Antwerp, and attracted much attention on account of the vigor with which the artist had treated his subject. Adolph Sutro saw the figure there after having read much favorable criticism of it in the press, and then the idea struck him that it might be an embellishment to the entire San Francisco peninsula. — *Providence Journal.*

WHAT "SATIN WALNUT" REALLY IS. — A few years ago a furniture manufacturer made up some pieces of furniture from red gum, and, wishing it not to be known what kind of wood was used, called it satin walnut. Satin, as applied to walnut, would indicate a finer, rarer wood than ordinary black walnut. A great many people were acquainted with gum. Its plebeian reputation was widespread. It was a cheap wood, and one of the best warpers extant. At that time the idea of putting gum into any but the commonest furniture, and that, too, almost exclusively in the South, was not abroad except in the mind of the man who thought there was a good deal in a name. The extent of the influence of one man's actions may be seen in the fact that the senseless name which a Chicago furniture man gave gum for the purpose of tricking his customers into buying furniture made from it has become a regular name in the Liverpool and London lumber reports. We are kept posted by the papers devoted to the lumber industry over there how American satin walnut is selling; and not long ago an American lumber journal desiring to tell its readers something about the London market because the *Lumberman* had set the example, copied from a London paper a report on satin walnut without informing its readers that the satin walnut it was talking about was nothing but plain American gum, presumably from the reason that the lumber journal was ignorant of the fact that satin walnut is American gum. Exporters may endeavor to pull the wool over the eyes of foreign buyers by showing them as fine-looking samples of lumber as they ever saw, the lumber fine-grained and tough, with a figure on which nature did some of her choicest work, and calling it satin walnut; but it is an effort pure and simple to dispose of a common American wood that grows in the Central and Southern States in great profusion, and is worth at the mill not to exceed from $10 to $14 a thousand, log run. Satin walnut is a name applied to the wood for the express purpose of deceiving. The wood should be known everywhere — at home and abroad — as gum, a name that need not escape the mind of any man, providing he associates to any extent with the maidens of his neighborhood. — *Northwestern Lumberman.*

THE STATE CAPITOL OF VIRGINIA. — The State Capitol at Richmond is the oldest building of the kind in America still used for its original purpose. It was built under the personal supervision of Thomas Jefferson, and is one of the historic buildings of the country. It stands upon a commanding hill and is surrounded by a beautiful grove, with well-kept walks, beautiful with statuary and monuments. Facing the capitol is the governor's mansion. To the right of the capitol is doubtless, the most magnificent and costly group of statuary in the Union. Surmounting a huge star-shaped pedestal of Virginia granite is Thomas Crawford's famous equestrian statue of Washington; and around it on each of the five points of the star are effigies of the Old Dominion's most celebrated ante-bellum soldiers and statesmen. There are Patrick Henry, the orator, Virginia's first governor; Thomas Jefferson; Gov. Thomas Nelson, who fired upon his own residence at the bombardment of Yorktown; Andrew Lewis, the Indian fighter, and John Marshall, long chief-justice of the United States. Inside of the building we find more pieces of statuary — the most celebrated of which is Houdon's Washington — "a *fac-simile*," Lafayette pronounced it. The mask of the statue was taken ten years before the president's death and the statue cast in Paris. There is also a marble statue of Henry Clay, presented to Virginia by the ladies of Kentucky, his adopted State. It will be remembered that his birthplace, "The Slashes," is only about eight miles from Richmond. Besides the statues in the rotunda of the building, there are many valuable paintings of colonial and revolutionary celebrities, as well as those of later times. The majority of the paintings are the originals, and in many instances the only ones in existence. There are, perhaps, the portraits of more great men hung on these walls, men who have made a name in national history, than any other State can boast. There are original portraits of Washington, Madison, Monroe, Tyler, Harrison, Marshall, Jackson, Johnston, the Lees, and a host of others whose names light up many a page of history. The old capitol has been the scene of much that is greatest in the history of Virginia and the South. In the hall of the House of Delegates the trial of Aaron Burr, the brilliant New Yorker, was held, John Marshall being the judge, and the erratic John Randolph of Roanoke, the foreman of the jury. Grouped irregularly around the historic Capitol square are the buildings once occupied by the various departments of the confederacy and the residences of the members of its cabinet. All of them are now used as hotels, stores, or private residences, with the exception of the president's mansion, which was purchased by the Municipal Government, and is used as a public school. — *New York Commercial Advertiser.*

THE GREAT SERPENT-MOUND. — Some unexpected developments have been made at the Great Serpent Mound in Adams County, fifteen miles southeast of this city. Such works have not been supposed to be burial places, but the men employed in excavating and examining a small mound near the Great Serpent have already unearthed ten skeletons in a good state of preservation. These have been boxed and forwarded to Peabody Institute. At the base of what is supposed to have been a stone cairn, and but about a foot beneath the surface, was found the skeleton of a female and child, the former being almost perfect, except the feet, which, it is thought, have been plowed up, as the ground has been under cultivation for several years. The skeleton of the child was all gone except the skull. Professor Putnam and family and a number of employés are encamped on the grounds, twelve tents being required to accommodate the party. The work of placing the grounds in good order is well advanced. The great serpent has been restored to its original form and proportions, as near as possible to do it, and a neat fence, with turn-stile entrances, now encircles this wonderful work. A vast amount of labor has been expended, and much more remains to be done, as the design is to plant trees, lay out walks, etc., and where the unknown people who built this singular mound once trod there will, in due time, be a beautiful park. The same parties that purchased the Great Serpent Mound are negotiating for Fort Hill, another ancient work that ranks among the most important to preserve. Fort Hill is in Highland County, near Sinking Spring, seventeen miles east of Hillsboro, O., and is nearly as great a curiosity as the Serpent Mound.— *Cincinnati Commercial Gazette.*

SOLID SAWDUST. — Parties in Bangor, says a newspaper correspondent, have recently obtained letters patent for the purpose of baling sawdust. I visited their location at Stern's mill, and found them pressing and putting sawdust into nice packages inclosed in burlaps — nearly one half-cord in a package. The power for pressing is obtained from a powerful hydraulic press. In the first temporary trial they pressed and baled fifteen cords in eight hours. This can be increased by increasing the number of cribs to seventy-five cords per day, and at

a very small cost. This material can be shipped to market for less than one-half the amount it will cost to ship it in bulk, and can be delivered at about the same price per cord. There are already orders received from street-railway companies in Boston for sawdust, to be used for bedding for horses instead of straw. It will not exceed one-half the expense, and should all the street-railway stables use it, the 10,000 horses they now have would require more than could be furnished by one press. In addition to this, there are 1,000 grocery stores and 1,100 liquor dealers, and all of these use more or less in packing goods and on floors. There are sixteen markets in Boston, and every floor is covered with sawdust. The amount of sawdust to be procured for the purpose of baling is much larger than would generally be estimated. The State of Maine alone manufactures 600,000,000 feet of lumber, and nearly one-sixth of the above amount is cut into sawdust. By utilizing this material we should find our docks kept clear of that which has been to many owners a nuisance.

Wood Stews in Northern Siberia. — Lieut. Wm. H. Schuetze, in the report of his mission to the Lena Delta, says that we have all had our sympathies aroused by statements that these people (the natives of Northern Siberia), are often, during famines, compelled to resort to wood for food. Now, the fact is that careless observers have simply been imposed upon, or they have jumped at conclusions without caring, or perhaps being able to make inquiries, and because they thought that a statement of these views would make a heartrending page for their books, and by inference show what a distressing time they themselves must have had among such surroundings. Wood, in a certain form, is a most common and constant article of diet on the Lena River, all along the north coast and in the immediate neighborhood of Yakutsk, in fact, wherever the Yakut resides. North of Verchoyansk, except in a few sheltered valleys, it may be said there is no other wood than the larch, and for miles south of the tree-limit absolutely no other. The natives eat it because they like it. Even when fish are plentiful it usually forms part of the evening meal, as the many cleanly-stripped larch logs near every hut testify. They know by experience that the fact of their eating wood arouses the sympathies of strangers, and shrewdly use it to excite pity and to obtain a gift of tea and tobacco. They scrape off the thick layers immediately under the bark of a log, and chopping it fine mix it with snow. It is then boiled in a kettle. Sometimes a little fish roe is mixed with it, and further south cow's milk or butter. I have often seen it eaten without anything additional, though, as in the present instance, there was apparently enough other food on hand.

Corrosion of Lead Pipes. — The excerpt minutes of the British Institution of Civil Engineers contain the following abstract of a paper by Dr. G. von Knorre, printed in the *Gesundheits Ingenieur*: —

The author states that during the past year he has had many opportunities of examining specimens of lead-pipes which have corroded in walls, owing to the action of mortar or cement, or in the soil. The behavior of lead exposed to the influence of the air, water, lime-water, etc., is briefly discussed. In damp air a bright, freshly-cut surface of lead becomes speedily coated with a thin scale of gray oxide, which adheres closely to the metal and prevents further oxidation. At ordinary temperature, in dry air, and in inclosed vessels specially protected from moisture by the presence of sulphuric acid or calcined chloride of calcium, lead undergoes no change; lead, however, in a fine state of subdivision, is speedily converted into protoxide. Water that has been boiled and which is free from oxygen, if air is excluded, does not dissolve lead. Shaken up with lead in the presence of air, water even in two hours takes up about 1-10 per cent of the metal. Even a corroded surface is thus attacked, and when the metal is alternately exposed to the influence of air and water the action is more rapid. All waters do not dissolve lead with equal freedom; and the presence of small quantities of carbonic acid and of certain bicarbonates retards the action, while chlorides, nitrates, and decomposing organic substances intensify it. The experiments of Pattison Muir bearing on this subject are specially quoted, as are also the results recently obtained by Lunge and Venator. Besnou had found that lime-water powerfully attacked lead, and the author, who has made careful investigation of the influence of lime-water on lead, states that if air is excluded, bright lead shavings remain unaltered in the liquid, but that, on the admission of air, the metal is at once vigorously attacked. If lead is exposed to the action of lime-putty, lime-water, or lime-mortar, air being also present, a pale yellow deposit of oxide of lead becomes visible, even in the course of a day or two, the part of the lead nearest to the surface of the putty, the lime-water, or the mortar, being the most freely attacked, because it is there that the air has the most ready access. The chemical reaction is a very simple one, the hydrated oxide of lead, formed in the presence of oxygen and moisture, is dissolved in the lime-water, and partially precipitated as yellow oxide, free from water (it being a well-known fact that under certain conditions the yellow anhydrous oxide of lead is set free from solutions of oxide of lead in the presence of caustic alkalies or lime-water as yellow or red crystals, forming a red powder). Such a precipitate of oxide of lead might be formed upon lead-pipe in mortar or cement containing caustic lime in the presence of air and moisture. Two specimens of corroded lead-pipe proved on analysis to contain in the corroded parts 99.05 and 99.37 per cent. of oxide of lead. The mortar in which the latter sample was imbedded was extremely alkaline when tested with litmus paper, and contained a considerable quantity of caustic lime. In certain specimens of corroded pipes forwarded to the author from the Berlin water-works, the part of the lead attacked was white and not yellow, and it was proved that when caustic lime is not present the hydrated oxide may be decomposed by the carbonic acid gas contained in the atmosphere, in which case a white basic carbonate of lead takes the place of the yellow oxide. Some analyses are given which show that these corroded pipes had been thus attacked, but that varying amounts of sulphuric acid, nitric acid, and chlorides were also present. The author states that these latter ingredients appear to him to play an important part in the corrosive action, for, on the analogy of the old plan of manufacturing white lead with small quantities of acetic acid in dung heaps, in which process the acetic acid only acted as a carrier, the first formed acetate of lead being at once converted into carbonate of lead by the carbonic acid evolved, it can readily be seen that nitric acid would play a similar part. Indeed, both the nitrates and chlorides are known to act just as well as carriers as the acetates formerly employed in white-lead making. In impure soils, rich in decaying organic matters, lead would be speedily attacked were it not for the absence of oxygen.

In a discussion on the paper it was pointed out by Mr. Oesten that though lead may be thus readily attacked, the whole of the necessary conditions are rarely united, as out of 20,000 lead house-connections in the city of Berlin, he had only after careful search, extending over a period of twelve months, found eight instances of corroded lead-piping.

TRADE SURVEYS

The addition of over fifty million dollars to the currency supply during the past four months has had the two-fold effect of arresting a threatened monetary stringency and of making a bull movement in stocks a possibility. The assurance of continued assistance of this character and the possibility of gold importations, an enlarging export trade, and an enlarged distribution of merchandise and material, crude and finished, in domestic markets, all have helped to strengthen confidence which gave evidence during the Fall of needing strength. Advices from the leading men in a half-dozen of our great industries corroborates what has been herein previously stated as to future trade probabilities. Railroad-builders are now withholding orders for steel rails, expecting a decline from $34 to $32 or less. The syndicate will restrict production if buyers hold out much longer. The possibility of a drop to $30 is recognized. The lumber interests have distributed this season's stocks pretty thoroughly, and this fact will lead to the largest winter logging operations ever known. The probabilities are that lumber prices for the coming spring will be lower than for last spring. Hardwoods have sold remarkably well this season, and the consumption has been greatly expanded. Yellow-pine supplies will be considerably increased next year in North Atlantic markets, and sawing preparations are now being made for that purpose. In fact, the question may well be asked concerning the wisdom of constructing such a large number of saw and planing mills South and West. The parties immediately interested are, after all, the best judges, and as most of these improvements are made with actual cash there will be no after consequences. In this industry, as in many others, there is an effort to not overdo, and to keep near to actual demand. Extensive lumber areas have been opened-up this year in Canada and south of the Great Lakes, as well as in the Central and Gulf States. The tendency will be to overcrowd the lumber markets, a fact which is leading the lumber manufacturers and dealers in the Northwest to prepare for by more compact trade organization No possible combination of interest, however, can arrest the competition of manufacturers, and prices will very probably be kept even closer to cost-limit than this year. Southern hardwood manufacturers have greatly expanded their trade in the North, and hardwood timber territory convenient to rail facilities has sharply improved in value. Car, boat, ship, house, mill and railroad building requirements will, no doubt, be as urgent next year as this. The reports to hand recently from several of the larger wood-working machinery makers in the Western States lend strength to the position taken concerning future enterprise in Western house, shop, and factory building. This industry has been able to keep from one to two months' orders ahead. The small towns in the West are the most pushing, and within the past year a great many little industries have taken root there because of lower taxes, less liability to labor dictation, lower wages, cheaper living, and as low freight-rates as are to be had in large cities. This, though an apparently trifling matter, possesses features worth noting. It means the breaking up in a large measure of great industrial communities in the same line. Paper-mills, cloth-mills, hosiery-factories, tool and hardware establishments are to be found in Western States where five years ago the possibility was not dreamed of. This tendency is exhibited in late commercial summaries which show that for one month, October, the volume of clearing-house returns in thirty-eight cities was $137,000,000 less than for October, 1886; but leaving out three Atlantic-coast cities it shows a gain of $133,000,000; that is to say, the empire of the Ohio and Mississippi Valleys is becoming more and more independent of Eastern connections in finances, manufactures, and in jobbing and distributing facilities. The builders of New England, so far as individual opinions have been expressed, are anticipating even greater activity in house and factory building next year. The satisfactory dividends of so many textile-manufacturing corporations have led to projections of additional mill room and greater motive power. House-building will grow apace. If there ever was any uncertainty as to the ability of New England textile manufacturing interests to maintain their competative supremacy as against other sections, the progress made during the past year has set such uncertainties aside. Capital has been strengthened by liberal returns. Large investments will be made in all six States. What were regarded as threatening evils two or more years ago have disappeared. Adverse legislation has not taken place. Employés have not accepted the frequent pays authorized by law. Arbitrative methods provided by law have not been found as necessary as was imagined. The low margins of two or three years ago have disappeared, and greater markets have loomed up to encourage enterprise. What is true of New England manufacturing interests is true of other sections. Unobserved factors are developing into importance. Demands are arising which are stimulating a higher order of mechanical and designing talent. The consumptive capacity of the people is enlarging, and old rules of action for traders and manufacturers are rules no longer. Hence those who are endeavoring to predict dulness next month or next year, or higher or lower prices, or expanding or contracting trade, or abundant or scarce money, or the use of speculative or legitimate values, are talking about matters too far beyond their ken to be listened to with seriousness. The material progress of the past decade has been a greater surprise to the people who have made it than to the outside world, and the progress of the next decade in the increase of comforts among the masses of the people will be even more surprising. This will be effected through cheapness, but there will be no attendant bankruptcy. All the agencies at work are pointing to lower prices, cheaper commodities, lower duties, less interest, more money, greater industrial and trade organization, and a greater control over the forces of production and distribution.

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CONTENTS

WE had the pleasure a few days ago of witnessing the application to an electric motor of a test which has, we believe, never before been applied to such machines. The motor was a large one, of the Sprague type, rated at fifteen horse-power, and was set up for use in driving two elevators in a mercantile building. The plant was a very compact one. The elevators ran in brick shafts, side by side, in the corner of the building. The motor was bolted to heavy timbers placed on the floor in the angle formed by the wall of one shaft and the main wall of the building, and a belt was carried from the small pulley on the motor-shaft to a thirty-inch pulley on a counter-shaft hung from the ceiling about ten feet away. Two more pulleys on the counter-shaft transmitted the power back again, one to the shaft of the worm-gear of the larger elevator, which was placed on the floor near the motor, and the other to the corresponding shaft of the small elevator machine, which was suspended from the ceiling nearly over the other. The motor-shaft, with a current supplied from the Edison station, made about fourteen hundred revolutions a minute, and the counter-shaft about four hundred. The Sprague motors are guaranteed, with a current of proper electro-motive force, to develop the power at which they are rated; and the object of the test was to determine mechanically, independent of electrical measurements of the current, whether the one in question did so; and for this purpose an Emerson power-scale was attached to the counter-shaft, to measure the exact amount of mechanical force developed at that point. If the power-scale could have been attached to the motor-shaft, the power developed could have been determined directly, without any allowance for loss in transmission; but the shaft, carrying only one pulley was too short to attach the apparatus, and its high velocity would have made it almost impossible to get accurate readings, even if other circumstances had been favorable. By attaching the scale to the counter-shaft, the ascertained power would be less than that actually developed, by whatever allowance must be made for the slipping of the main belt, which could not readily be determined, but no more accurate test seemed to be practicable. The first test was made by loading one elevator with a ton and a half of goods, increasing the load to four thousand and ten pounds, and noting the time consumed in making the trip, as well as the indications of the scale, while the electrical pressure was at the same time observed. The motor lifted the weight of four thousand pounds without difficulty, and the other elevator was then loaded, at first with eleven hundred pounds only. In order to avoid the excessive strains, together with the sparking of the brushes, which would follow from starting both elevators, heavily loaded, at once, an interval of a few seconds was allowed to elapse after starting the large one before pulling the shipper-rope of the small one, and both were then raised without difficulty. With fifteen hundred and sixty-eight pounds on the small elevator, and four thousand and ten on the other, both elevators made their trips nearly together, without any difficulty, although there was a good deal of sparking of one brush; but on adding three hundred pounds to the weight on the small elevator, although both elevators started, and moved some distance upward, the strain of the load, added to the great friction, which kept several of the journals smoking, made too great a demand upon the current, and the safety-plug, which forms the connection with the outside lines, gave way, cutting off the current. A simple calculation then showed that with fifty-five hundred and seventy-eight pounds on the two elevators, lifted eighty-one feet in one minute and thirty-five seconds, a force of a little less than nine horse-power was exerted at the elevators. The power-scale reading at the same time showed that twenty and seventy-seven one-hundredths horse-power was developed at the counter-shaft, and the electrical readings, reduced, showed a somewhat greater electrical horse-power consumed by the motor. The difference between the force at the counter-shaft and that exerted in raising the load, was, of course, consumed by friction in the elevator machinery, and the uncounterbalanced weight of the elevator platforms, which would amount to about five hundred pounds. Undoubtedly, with a little adjusting and smoothing of the new elevator machines, the loss by friction would be greatly lessened, and it is a matter of considerable interest to those who use electric motors for furnishing a given power to know that, if all are like the one tested, a certain extra force can, on occasion, be obtained from them, as it can from a steam-engine. The other point determined in the present instance by the test, — that of the loss by friction in a well-made elevator machine, can hardly be said to have been authoritatively decided, as such machines are usually thought to consume much less than half the power supplied to them in friction, and the heating of the journals showed that there were here some extraordinary obstacles to free working.

A GOOD deal is to be learned from the official specifications for the buildings of the Paris Exposition of 1889, which are published at intervals. In the specification for iron roofs, particularly, are to be found many interesting, and to us rather novel details. Of course, these great roofs are composed of innumerable pieces of wrought-iron riveted together, and every portion of the work is provided for. To try the quality of the metal, two tests are required, one applied to the hot iron and the other to the cold. The hot test for plate-iron is a very simple one, consisting in the rolling of a specimen from each lot of plates into a cylinder, the height and diameter of which are each to be twenty-five times the thickness of the plate. The finished cylinders are to show no cracks or signs of rupture. For the cold tests, specimens of a given size are required to resist a tensile strain of at least twenty-eight kilogrammes to the square millimeter before breaking, and to show a lengthening of at least three per cent. For angle-irons, one hot test consists in rolling samples into a circle, in which one leg of the iron shall form a cylinder, whose diameter shall be five times the breadth of the other leg, while the second leg, after rolling, shall form a flange at right angles at all points with the cylindrical surface. The second hot test consists in opening samples of the angle-irons until the legs form an angle of one hundred and thirty-five degrees with each other; and the third test consists in closing the legs together until they enclose an angle of forty-five degrees. The cold test of the angle-irons is a tensile one, but a higher resistance is demanded than in the case of the plates, the angle samples being required to resist an average strain of thirty-four kilogrammes to the square millimeter before breaking, and to elongate to the extent of nine per cent under that strain. The cold test for I-beams is the same as that for angles. The hot test consists in splitting a sample through the middle of the web to a distance from the end equal to three times the depth of the beam, drilling a hole at the end of the split to prevent it from extending further, and then heating the sample and separating the two portions until the space between them at the extremity is equal to the depth of the beam. All the specimens of iron are required to bear these tests without cracking. The directions for riveting and setting in place are as minute as the others, and the portion of the specification relating to painting is curious in many respects. Instead of daubing the iron with paint, over the rust and

dirt, the pieces as well as metal, are, as soon as they are drilled and fitted, to be scraped and cleaned all over, so that no trace of rust shall remain, and are then to have a coat of linseed oil, which must be put on under cover, or at least in dry weather. After drying, the oil coat is to be scraped and smoothed, and such portions as are put together in the workshop are then to be riveted, and immediately afterward painted all over with red lead. After setting in place at the building, the work is to be examined, new rivets and joints and portions scraped in handling retouched with red lead, and the whole then painted with a final coat of red or white lead, as shall be directed by the architect. The colors are in all cases to be ground with drying oil and thinned as required with equal parts of linseed oil and turpentine.

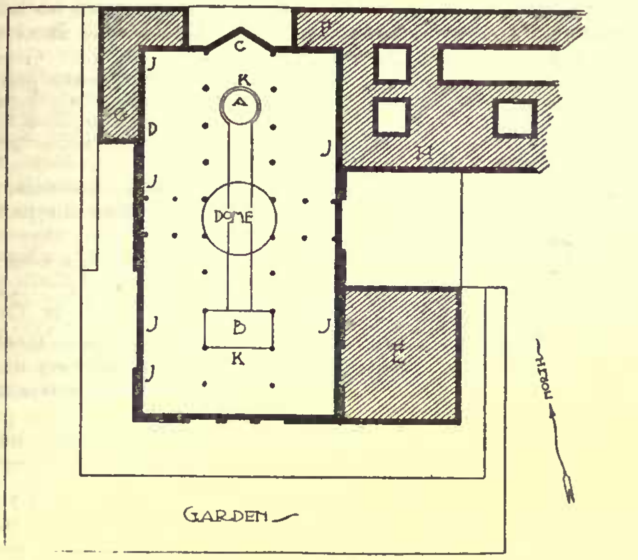
A STORY is published in the New York *Mail* and *Express*, to the effect that the great Eiffel tower in the Champ de Mars in Paris, which was to be one of the most striking features of the Exhibition of 1889, is to be abandoned. The structure is already built about a hundred and forty feet high, and it seems very singular that such an enterprise, in full process of execution, should be suddenly given up; but the *Mail's* correspondent says that workmen cannot be found who will risk their lives, as they think, on the structure. We have as yet no information in regard to the matter from French sources; but it will seem a little strange if, so soon after the Germans have finished two stone towers, five hundred and ten feet high, and the Americans one of five hundred and twenty-five feet, the courage of the French should give out at an elevation of one hundred and forty feet, on an iron structure, which affords infinitely better facilities for arranging good and safe scaffolding than a stone tower.

ARCHITECTS in active practice generally take much interest in the professional schools which prepare for them the young men who are to be their assistants and successors, but do not always know how much they can do, without very great effort, to promote the efficiency of such schools. One of the most serious dangers to be avoided in the conduct of a technical school is that of allowing it to drift away from the problems of actual professional life, and become absorbed in theory, to the exclusion of practical application of the principles which have been taught. In dealing with so many-sided an art as that of architecture, it is particularly necessary to see that no portion is taught merely as an abstract subject of thought, but that all parts are vivified by references to existing examples, and the observation of actual processes and results; and in the attainment of this end the coöperation of the profession outside is of great use. The perfect institution of technical learning, while never abandoning for a moment its high standard of scientific attainment, should be in constant sympathy with the exterior professional world, sharing its interests, and trying to utilize both its successes and reverses in making its own teaching more efficient. For this purpose, in a school of architecture, frequent and direct communication with practising architects is of great value. Any school worthy of the name would keep itself informed, by means of the technical journals, in regard to what was going on in the profession, but this does not take the place of direct communication, by personal visits, the gift of photographs and drawings, or of details of construction, or sets of plans; which, although every-day matters in architects' offices, seldom find their way to the schools, where they are highly prized, not only for their practical air, which gives them an interest far superior to that of the stock diagrams in the text-books, but for the help that they give in illustrating contemporary developments in architectural science, which are not usually shown in text-books for years after they have become familiar in the profession.

THE rival schools of archæology at Athens accomplish an immense amount of work, which would probably never be attempted except for their efforts. According to the *Messager d'Athènes*, the pupils of the French school at Athens, under the direction of M. Gustave Fougères, have undertaken explorations at Mantinea, the principal city of ancient Arcadia, and the scene of the great battle between the Thebans under Epaminondas and the united forces of nearly all the rest of Greece. Although Arcadia was a pastoral country, and Mantinea a comparatively rude provincial town, the excavations have brought to light well-paved streets, a market-place surrounded by a portico, a large number of fragments of Doric colonnades, and many beautiful fragments of sculpture, a few of which date only from the time of the Romans, while the others are of various periods of purely Greek art. In certain respects, Arcadia is the most interesting portion of Greece. Curiously enough, no one seems to know whether the present inhabitants of the peninsula are descended from the ancient Greeks or not. It is certain that after the fall of the Roman power great numbers of Slavic barbarians, like those who colonized the present provinces of Bulgaria and Roumelia, just to the north, invaded Greece, and, notwithstanding the persistence of the ancient language, in a modified form, there are many archæologists who assert that the small, black-haired, olive-skinned people who inhabit nearly all the territory of ancient Greece, and call themselves by the antique Greek names, are pure Slavs, without a drop of Hellenic blood in their veins. What has become of the ancient race they do not pretend to say positively, but they believe that it was almost entirely exterminated by the Northern invaders, and, in proof of this position, they point to the present Arcadian mountaineers, who are tall and handsome, with fair complexions and light, curling hair, such as the Greek poets describe, and Phidias represented in his sculptures, saying that the original Hellenic inhabitants, flying before the barbarous hordes of the Dark Ages, took refuge in the mountains, and there alone, defended by Nature, have been able to maintain themselves, and repel the advances of foreign enemies. In opposition to this theory, a later school of archæologists professes to have discovered that, instead of being pure Hellenes, the fair-haired Arcadians are pure Slavs, the descendants of those who, after their invasion of the country, had been forced by a revolt to take shelter in the mountains while the dark-haired natives, the true offspring of the ancient Greeks, were engaged in the effectual extermination of all the Slavs who remained in the accessible parts of the country. There would seem to be a tolerably wide liberty of choice between these two theories, but a third is offered, founded upon the fact that the Arcadians in classic times believed themselves to be of an aboriginal race, far more ancient than that of the people who inhabited the low lands around them, which suggests that instead of being either Hellenes or Slavs, the handsome mountaineers may possibly be the surviving representatives of a Pelasgic or other prehistoric race, while the small lowlanders are of a descent so much more recent that it is of small importance whether they are Greeks or barbarians in blood, or a mixture of both. The ethnology of the Alpine valleys, in which are said to be found remnants of every race which has ever invaded Europe, indicates the possibility of the persistence in the Peloponnesus of an aboriginal type, and the explorations at Mantinea, if they bring to light nothing else of importance, may perhaps serve to clear up this curious question.

A GOOD many years ago, according to the veracious history of Ovid, a young man who had succeeded in borrowing a pair of wings, and a cap which made him invisible when he put it on, together with a diamond dagger, went on a hunting expedition after Gorgons. His somewhat unusual equipments brought him success, and he returned home with the head of his quarry as a trophy. On the way a drop of blood from the head fell to the ground, and immediately turned into a winged horse, which flew over the sea, and alighted on a wooded hill. Here he pawed the ground, and a spring gushed out. This attracted the attention of the people of the neighborhood, and the winged horse was captured and tamed; and, after a few years of usefulness, flew up to the sky, where he may still be seen; while the spring which he evoked continues to flow. Unfortunately, the climate of the locality has apparently changed since Jupiter's daughters danced upon Mount Helicon, and the spring of Hippocrene, together with the rivulet on whose banks the Graces once lived, now serves to feed a gloomy swamp, so poisonous in its emanations that the inhabitants of villages ten or twelve miles distant often die from the effect of the malaria. After two thousand years of endurance, they have at last taken decisive steps to remove the trouble, and a canal is in process of construction which will drain the swamp, or rather the Lake Copaïs, and convert it into an arable plain. The lake lies high enough to drain naturally into the sea, but three ranges of hills intercept the direct route, and it will be necessary to tunnel all of them to obtain a free outlet. When this is done, an area of more than sixty thousand acres of extremely rich land will be secured for cultivation, and the cost of the work, great as it is, will be well repaid.

THE INTERIOR OF THE CATHEDRAL IN THE CITY OF MEXICO.



THE great Cathedral in the city of Mexico has been so frequently pictorially represented to American readers that its outlines must be by this time quite as familiar as those of St. Paul's or Westminster Abbey. If this be not so, the present reader can turn back to *The American Architect and Building News* of September 19, 1885 (No. 508), and find there a double-page illustration of that magnificent structure, showing its exterior to a good advantage. All that could be added to that illustration as regards the exterior of the building would be a view of the elaborately-carved "*Churrigueresque*" façade of the Sagrario or parochial church, which does not come out with sufficient distinctness in the above-named illustration. The Sagrario is in many respects distinct from the cathedral, owing its existence to a different organization, built at a much later period, and with a different object in view, but it forms, nevertheless, part of the cathedral group of buildings, from which the observer would find it scarcely possible to separate it. It is also so connected with the cathedral's interior that visitors pass from one to the other scarcely noticing that the two buildings are distinct.

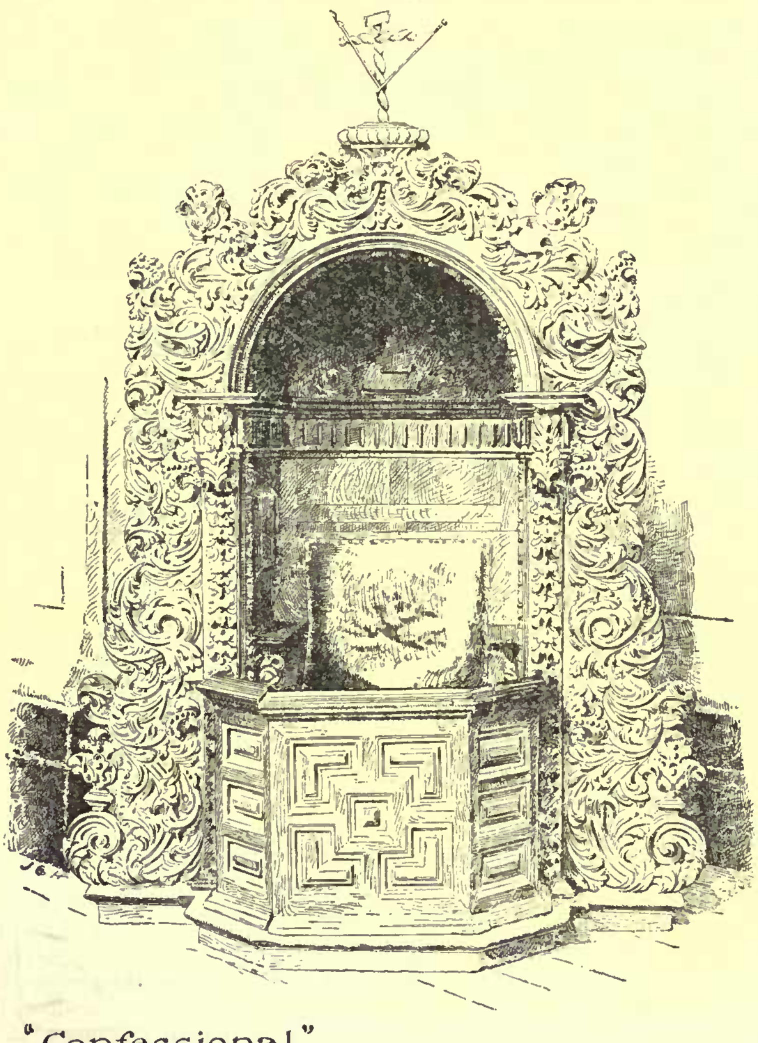
Few attempts, if any, have been made to illustrate the interior of the cathedral, and it is, therefore, less familiar to those who have not visited it. The purpose of this paper is to so illustrate it by means of views, with only so many words as will be necessary to explain the pictures.

The accompanying sketch of the ground-plan will best explain the interior arrangement of choir and high altar. The choir, separately illustrated, is in itself worthy of close study. The lattice-work is of tumbago, a mixture of gold, silver and copper, imported from Macao. The same metal is used in the railing on both sides of the passage-way leading from the choir to the high altar. There is a tradition that this metal is more valuable than silver and that parties have repeatedly offered to replace all the tumbago used in the cathedral with an equal amount of pure silver for the sake of the tumbago, but, though this tradition is repeated almost daily to American visitors, there is an air of improbability about it. The interior of the choir is arranged with tiers of seats upon three sides. In the centre is a large square revolving-stand, bearing upon its four reclining sides, immense music-books, in which the music of the mass and vesper services are engrossed upon vellum. Each book is a marvel of illumination, and would be a prize to any collector of curios. There is an organ in a carved wooden case upon each side of the choir, extending up to the roof.

The high altar is an error in taste, not only by reason of its position, but also as to its design. It is a glaring anachronism in the first place, having been erected about the middle of the present century, while the walls around it are of the sixteenth and seventeenth centuries. Its design is quite out of harmony with its surroundings and particularly as different colored marbles have been used in it, the columns being of mottled green, not at all in keeping with the sombre tone of the stone columns and arches which support the roof, the bronze color of the tumbago railings and statues, and the age-mellowed tone of the carved-wood lattices of the sacristy. It appears as something foreign to the place in which it exists. It replaced an altar of more suitable design. Some of the figures apparently attached to it are of wood and movable. Stucco, paint and gilding have been made to eke out some of the effects which the architect attempted to produce, and the whole is a sorry medley. Why it should be called the Cypress (*el cipres*) Altar is as yet unexplained. Its position in the church is such as to break the imposing effect of the interior. It shuts off the view of the elegant Kings' Chapel, also of Churrigueresque elaboration and of tumbago. Were both the choir and the high altar removed from their present central position, the effect of the high arches and heavy fluted columns, supporting the vaulted roof, would be very impressive. The floor of plank is another defect of the building. It has probably been laid upon a pavement within the last decade or so. The interior is lighted from the dome and from windows high above the floor. Without looking for them especially, one might visit the cathedral a dozen times without noticing the windows.

The cathedral suffered somewhat during the great "Reform" period, when all the churches of Mexico had to give up something to the insatiable government. The archbishop removed some handsome paintings, it is said, to his own rooms and still keeps them there. A Murillo is said to exist in the Chapter-House, but I never succeeded in finding it. Some of the frescos are worthy of study: that within the dome, of course, escaping the attention of most visitors, is of "The Assumption." There are two fine paintings in the choir, and the sacristy contains several. Some good paintings by Mexican artists are arranged in the details of the Kings' Chapel or altar.

The church possesses seven chapels besides that of the Kings. One is dedicated to San Felipe de Jesus, a native of Mexico, who was crucified in Japan and has been canonized as a saint and martyr. His chapel contains the sarcophagus of Augustine de Iturbide, Emperor of Mexico just after the Independence. The chapel of the Kings is said to contain the skulls of Hidalgo, Allende, Aldama and Jimenez, early martyrs of the Independence of Mexico.



"Confessional" in Cathedral. Mexico.

With all of its architectural defects, the interior of the cathedral is grand and imposing. Visitors are seldom satisfied with a single visit. They return to it again and again, as often as time will allow. It would be impossible for me to state how many times I have visited it, either to watch the services going on (not generally so fine as might be expected in a Roman Catholic country and in so magnificent a cathedral), to listen to the music of the great organs, to watch the motley crowds who resort there to worship, or, more than anything else, to study the lines which go to make up its imposing interior.

ARTHUR HOWARD NOLL.

[1] Explanation of Plan of Cathedral of Mexico: — *A.* High Altar; *B.* Choir; *C.* Kings' Chapel; *D.* Chapel of S. Felipe; *E.* Sagrario; *F.* Sacristy; *G.* Archicofradia; *H.* Chapter-House; *J.* Chapels; *K.* Altars.

ANCIENT AND MODERN LIGHT-HOUSES.[1] — XVI.

RED SAND LIGHT-HOUSE. — (*Continued.*)

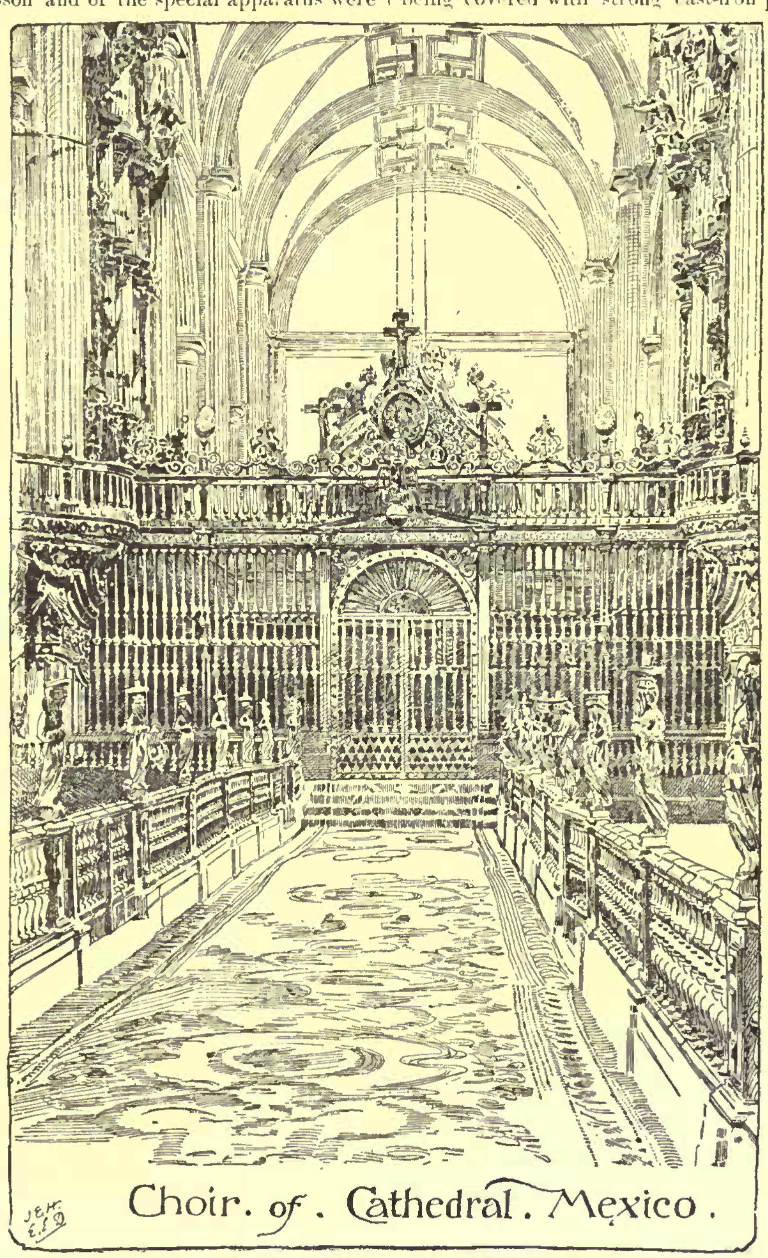


From Tournai Belgium

THE following March (1882) Herr Hanks asked the Harkoort Company if they would make a trial to erect a light-house at this locality, and this company, in June, submitted a bid in accordance with their original project. The contract was signed on September 21. The total price for the complete structure, ready for occupancy, but exclusive of the lens and illuminating apparatus, amounted to $213,500, which was later increased by $3,250 on account of alterations made in the height and construction of the upper part of the tower.

The mistakes and errors of omission made at the first trial were of great value to the Harkoort Company — the general plan remained the same and it only remained to execute the details in the proper manner to ensure success.

While the contract was under discussion all the necessary drawings for the details of the caisson and of the special apparatus were prepared, so the work was commenced immediately after the signing of the contract.



Choir. of. Cathedral. Mexico.

The structure consisted, generally speaking, of two parts — the foundation and the tower. The first, of course, was the only part which offered any engineering difficulties.

To build this foundation a caisson was used which, after being sunk to the required depth, was to be filled with masonry and concrete, on which the tower could be erected. The caisson, in plan, resembled a section of a bi-convex lens. It was thirty-six feet eight inches wide, forty-six feet eight inches long, and sixty-one feet eight inches high when it was towed to the site; this height was gradually increased during the sinking to one hundred and seven feet six inches.

The caisson was made of boiler iron four-tenths inches in thickness, was well braced vertically and horizontally, and none but the best material was employed in its construction. It was calculated to withstand a hydrostatic pressure produced by a column of water twenty feet high.

Eight feet four inches above the cutting edge of the caisson was an iron diaphragm, forming the top of the working-chamber, carried by two longitudinal and twelve cross girders. This was also very strongly braced to the walls by a great number of iron brackets. From its centre rose the cylindrical air-shaft, three feet four inches in diameter, provided with an air-lock.

This air-lock had four chambers — two for the use of the men and two for the supply and discharge of material, and was provided with a steam winch for hoisting the sand. Besides, there were six pipes to be used for blowing out the sand if it were found practical to use this more expeditious method.

The upper part of the caisson was divided into four stories. The first, or lowest, was for mixing concrete; the next was the machinery floor, and carried two boilers, one air-compressor, a surface condenser, a centrifugal pump, the coal, and fresh water, and the steam-pipes leading to the two steam hoisting-cranes, to the compressor, and to the winch of the air-lock.

On the third floor were two sleeping-rooms and store-rooms; from this floor access was gained to the air-lock. The top story carried two revolving steam cranes.

As the work progressed the upper three floors would have to be raised from time to time, and it was important that this should be done without interfering with the other work.

This was accomplished by suspending the two upper floors by four long and strong screws to the vertical ribs of the caisson, which were made higher for this purpose. The second floor was suspended from the fourth by four other screws, and there was another screw in the centre of the fourth floor for raising the air-lock.

By means of these nine screws, all worked from the top floor, the raising of the floors, with everything on them, was effected by a few men without delay to the work.

This was a far superior arrangement to that previously adopted, which required the cessation of all work while the platform was being raised, and in addition, the interior wooden bracing of the caisson was always much in the way.

When the caisson reached the Red Sand Shoal it was to be sunk to a depth of about seventy-three feet below mean low water, and then filled with concrete and masonry to six and two-thirds feet above the same level.

This foundation was to support a tower with a circular base of thirty-four and two-thirds feet, the offset round the foot of the tower being covered with strong cast-iron plates securely fastened to the foundation. To a height of twenty-six and two-thirds feet above the foundation the tower is trumpet-shaped. At this height its diameter is reduced to twenty-three and one-third feet, and this part is solid masonry except the spaces left for cisterns and for the float of the tide-guage.

The portion above the cellar was to be lined with a twenty-one inch brick wall, and have a fireproof ceiling of corrugated iron and concrete.

The upper stories were to have an iron shell with a double wooden lining, lathed and plastered.

Above the living-room is an iron gallery eighty-one and two-thirds feet above low water, and at this height the tower is reduced in diameter to seventeen feet.

Two of the three semi-circular dormers, or small towers, at the gallery level contain range lights, and the third is used as a watch-room. One also contains the stairway leading to the gallery and lantern of the main light. The latter is eleven feet in diameter, and is covered by a copper roof on which is the ventilator one hundred and two and two-thirds feet above low water.

The following is the method employed in transporting the caisson to the site:

The depth of water in the harbor and on the shoals, over which the caisson was to pass on its way to the site permitted a draft of only twenty-three and one-third feet, and in calculating the stability of the caisson the probability of encountering a moderate storm was taken into account.

It was assumed that the caisson would be safe and not capsize when subjected to a wind pressure of about two hundred pounds to the square yard — corresponding to a wind velocity of one hundred feet per second. The caisson was to carry all the machinery previously mentioned, which was to be so arranged that work could be commenced as soon as the caisson was sunk on the shoal, and at the same time it was to be placed as low as possible so as to lower the centre of gravity of the floating mass.

To accomplish this the bulkheads on which the machinery floor rested were provided with four hinged rectangular frames which, when raised vertically, supported the floor in a position ten feet higher.

[1] Continued from page 144, No. 613.

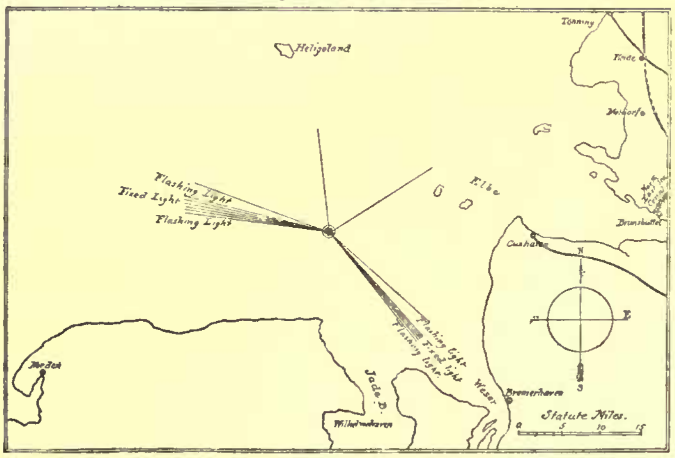
It was also important to build the iron shell as high as possible so that after the caisson was sunk it would project sufficiently above the water to prevent the entrance of the sea. Owing, however, to its great weight, this height did not exceed sixty-two and one-half feet, four and one-sixth feet higher than at the first trial.

Sufficient ballast was added to bring the draft to twenty-three and one-third feet, but a careful calculation showed that the stability, with reference to the assumed wind-pressure, was not sufficient. The elongated shape of the caisson required more support at the sides, and to attain this two pontoons were used. They were made of boiler-iron, air-tight, twenty-six and two-thirds feet long, six and two-thirds feet wide, and ten feet high, and had strong lugs fitting into concavities in the shell. Each was provided with a pump for admitting water and with an air-cock, which were so arranged as to be operated from the caisson.

When the latter floated at twenty-three and one-third feet draft the pontoons sunk three and two-thirds feet into the water. When the caisson rolled one pontoon sunk deeper than the other, counteracting the tendency of the structure to leave a vertical position.

It will be seen from the preceding that the most important part of

Rothersand Light House mt.



the execution of the work was the construction of the caisson with all the requisites for transportation, sinking by the pneumatic process, etc.

The contract with the Government was signed in October, 1882, and on the 1st of April, 1883, the caisson was completed as described, and moored at Kaiserhaven ready for transportation.

In the meantime, the necessary vessels and steamers required had been chartered; they consisted of the "*Palme*," on which the men were to be quartered, and which was to be moored near the work. The "*Solide*," a tug which was to tow all vessels to Bremerhaven, in case the weather compelled them to make a harbor. Two solidly built sail-boats, the "*Leopoldine*" and "*Maria*," carried the men between the "*Palme*" and the structure. In addition several vessels and the tug "*Otto*" were employed for carrying material, and kept a constant communication between Bremerhaven and the site.

For the transportation of the caisson to the site, the "*Samson*" and the "*Nord See*," the two strongest tugs of the North German Lloyd were chartered, and in addition the tugs "*Solide*," "*Herkules*" and "*Otto*," were to assist if required. Three special tow lines, 4 8-10 inches in diameter, were constructed for the purpose; two were attached to the stem and one to the stern of the structure, about eleven feet below the surface of the water.

The meteorological station at Hamburg had kindly promised to telegraph daily the weather indications during April and May, and the state of the wind at Waugeroog and Neuwerk, two stations in the neighborhood of the shoal. The weather in April was so unfavorable that the station at Hamburg advised not to start until May 14; this delay was very expensive to the contractors, as they had all the vessels and eighty men under pay during this time.

On the 15th of May good weather was prophesied, but the flood-tide did not rise high enough to float the structure out of the harbor, and then the weather became bad again.

Finally, on the 25th of May favorable news was received from Hamburg, and everything was got ready to start at 2.30 A. M. on the 26th. At 3.30 A. M. the tide had risen high enough to open the gates of the basin, and soon after the caisson, which nearly touched the sills and jambs of the gates, was towed into the Weser. Immediately afterwards the German flag was hoisted on the colossus. The tug "*Nord See*" was ready to take the hawser, and though it was difficult to overhaul the latter on account of its great weight and stiffness, this was quickly done. Then the "*Samson*" fastened its hawser to the "*Nord See*," and both headed for the site. The other steamers and sailing vessels, nine in all, accompanied the tow, making quite a fine naval pageant. The contractors' steamer headed the procession, indicating the deepest channel, and thus all shoals were passed in safety. Quietly and majestically the caisson floated down the Weser with the ebb-current, and so quickly that it arrived at Droorgat at 7.15 A. M. The strength of the ebb had greatly diminished, and as it was impossible to reach the site before the tide changed, the caisson was anchored near the Eversand shoal to wait for the next high water at 4 P. M.

The flood-current increased so much by 11 A. M. that the anchors of both tugs commenced to drag. Their engines were quickly started and the "*Solide*" was called to their assistance, but as all three could not prevent the caisson from drifting, the "*Herkules*" was also called upon. The combined strength of these four steamers, about 350 horse-power, held the caisson and when the flood diminished they were enabled to proceed, so that at 2.30 P. M. the caisson reached the Hohewey Light-house and came to anchor again. Hardly had it arrived when a signal from the Light-house announced the arrival of a telegram from Hamburg, stating that the wind would change to north, and that squalls were approaching from England. In a short time clouds commenced to rise, the sky turned the color of sulphur, the sea got rough, rain and wind followed, and at 4.50 P. M. the fleet was in the centre of a storm, which caused great anxiety. However, the caisson stood the storm remarkably well, rolling very little as the pontons gave it excellent support.

This storm prevented the continuance of the journey, the watch on the caisson, twelve men, were relieved by others, and by 8 P. M. the whole fleet was got ready for the night.

The delay was troublesome, as at every change of the tide the caisson swung round and had to be guided by the tugs, this manœuvre was difficult to execute in the darkness, but was successfully accomplished.

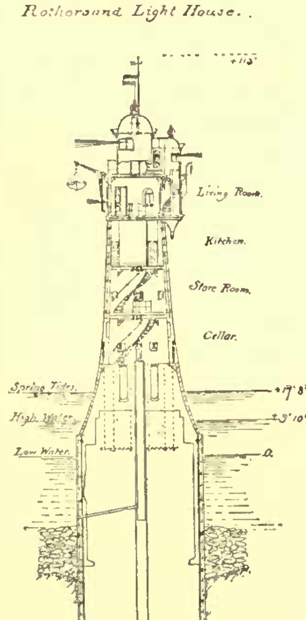
The following day the weather was bad, and the start was postponed until the succeeding one at 7.30, A. M. when the anchors were weighed and the seaward journey re-commenced. When, as the report has it, "in spite of the rough sea, the colossus parted the water with ease, wind and water did not affect his majestic dignity."

At 9 A. M. the Bremen Light-ship was passed, at 9.30 the dangerous "Rothen Grund," and at 10 the tow arrived at the place where a wreck buoy located the position of the former ill-fated caisson.

A little over twelve hundred yards below where this caisson was wrecked a buoy, painted black, white and red marked the spot where the tower was to be erected.

The Harbor-Master and the Chief-Engineer boarded the caisson; slowly and carefully the tugs brought the structure nearer and nearer, and when about one hundred yards distant from the buoy — exactly at eleven o'clock — the raising of the flag on the caisson gave the signal for all anchors to be dropped overboard. Both valves for admitting water to the caisson were opened, and the latter slowly and steadily, and perfectly plumb, sank to the bottom of the sea. A slight shock, at 11:15, indicated that it landed on the shoal. A second time the flag was raised and was greeted with loud cheers by all who witnessed the performance.

Rothersand Light House.



The heavy hawsers were removed, and the large tugs left the site and returned to Bremen. The most pressing work was now to release the pontons which were invisible, being about two yards below the surface of the water. By opening the valves sufficient water was admitted into the pontoons to overcome their buoyancy, they then began to sink, thereby disengaging themselves from the caisson. As soon as they were free the valves were closed again and both pontoons were sunk in the neighborhood where they soon after disappeared in the sand of the shoal. The increased current which was produced in the vicinity of the caisson at once scoured the shoal to a depth of three feet near by, diminishing to nothing at a distance of one hundred yards.

In addition, the first flood-current scoured a hole alongside of the caisson facing the current, inclining the caisson toward the north four degrees; during the following ebb-current the south side was undermined, and the caisson inclined the same amount to the south. In this manner, moving like a pendulum, the caisson sunk itself in four days more than six feet in the shoal. On the first of June the cutting edge was thirty-five feet below low water and the ceiling of the working-chamber commenced to bear upon the surface of the shoal. This self-sinking finally ceased entirely at thirty-seven feet below low water, when the large number of brush mattresses which had been sunk on the shoal prevented further scour.

The remainder of the working season was devoted to sinking the

caisson by the pneumatic process, to filling it with concrete and masonry, to placing additional mattresses and rip-rap around it, and to building the iron shell as high as possible. On October 15, 1883, the cutting edge was fifty-two feet below low water, the concrete level was thirty-six-and-two-thirds feet above low water, the top of the masonry was eight-and-two-thirds feet above low water, the upper edge of the highest completed section of the iron caisson, and also the height of the floor of the quarters for the temporary keepers was thirty-seven-and-one-quarter feet above low water, and finally the uppermost floor with the steam cranes, and also the upper edge of the unfinished section of the caisson was forty-seven-and-one quarter feet above low water, or ninety-nine-and-one-quarter feet above the cutting edge. On this day the workmen were compelled to leave the station as the strong southeast wind made it impossible to go near the caisson. The vessels anchored at the Eversand shoal to wait for better weather, but on October 16th the weather became worse, and the wind and sea increasing in violence, they returned to Bremerhaven. On the 17th and 18th of October, 1883, it was storming as it did on October 13, 1881, when the first caisson was destroyed. This time, however, but little damage was done. According to the reports of the two temporary keepers, stationed on the structure, a single wave, on the 18th of October, tore asunder one of the plates of the top section of the caisson and bent up two others which had not been bolted together, and were consequently liable to such destruction. Two heavy boxes of bolts were blown from the upper floor, the caging around one of the steam cranes was greatly damaged, and one of the keepers was violently thrown by a wave to the floor of his room as he attempted to leave it.

After this storm, which was followed by others of equal violence, but little work could be done during the winter. The air-lock and the machinery floor were raised so that the latter stood at a level twenty feet above low water. The masonry and concrete were also raised twenty and forty inches respectively, and a Pintsch gas apparatus with lantern and light visible six to seven nautical miles was erected.

Work was commenced in February, 1884, and continued until November, with many interruptions from wind and weather. The required depth, seventy-three feet below low water, to which the caisson was to be sunk, was attained on the 21st of May, 1884, one year after the caisson was launched at the site, and at the same time the level of the concrete and masonry had reached a height of three feet four inches above low water. Over two thousand cubic yards of sand, in addition to that which had leaked into the working-chamber from without, was all removed from the latter by the sand blast. The sand was very fine and mixed with small shells. A layer of stones was reached when near the required depth, but as it was not necessary to remove them; no use was made of the steam crane in the air-lock.

In June the machinery and boilers were removed, and by November the solid substructure of the tower, the cellar, the storerooms and kitchen were completed, and a part of the exterior walls of the living-room was put up.

Good progress was also made in securing the sand around the foundation. According to contract, the latter was to be covered with brush mattresses thirty inches thick and over a width of fifty feet around the tower, held down by a layer of rip-rap twenty inches thick, first filling all depressions caused by the scour during the construction of the foundation. This scour was much greater than had been anticipated.

This work was accomplished with great difficulty, and it was not until the middle of the following year that it was completed: sixty-six hundred cubic yards of mattresses and eight hundred cubic yards of stone were needed.

On December 2, 1884, Herr Kröte, who represented the Government during the construction of the tower, wished to inspect it once more prior to a pleasure trip during the Christmas holidays, and left in company with the Constructing Engineer to stay but a short time. They had hardly made a landing when a storm arose which made it impossible to take off the inspecting party. At first they rather enjoyed their detention, but when days lengthened into weeks and there was still no possibility of release, the situation became grave, especially as they signalled that one of the men was seriously ill. Finally, on December 21, with the sea still running high, all were successfully taken off except two men who were left to act as keepers during the winter.

Work was recommenced on April 12, 1885, the living-room and its three dormers, the lantern and the interior finish completed by August 10th and the main lens set up.

The main light of the fourth order, with Otter's revolving shutters, guides the incoming vessel first to the tower, and from there into the narrow channel leading to the Hoheweg Light-house. Each of these courses is marked by a fixed light, illuminating an arc of seven degrees toward the sea, and an arc of three-and-one-half degrees toward the river (see chart). In passing the limit to either side of these courses the fixed main light changes to a flashing light. The distance from the tower, where a vessel approaching the light has to change its course, is indicated by two fifth-order lights, one in the northwest, the other in the south dormer, about seventeen feet below the main light. The intensity is so regulated that they only appear to the naked eye as separate lights at a distance of two-and-one-half nautical miles from the tower; at a greater distance they cannot be distinguished as they are overpowered by the main light. Finally, another light of the fifth order was placed in the dormer containing the stairs, to locate the range on which vessels, coming from the Island of Heligoland, enter the mouth of the Weser.

The base of the structure, for a height of twenty-seven feet, is painted black, and the tower above, with alternate red and white bands fourteen feet wide. This makes the tower so conspicuous that it can be seen on a clear day for a distance of twelve nautical miles.

By the end of August the upper part of the caisson was taken down; in September the tower was connected to the shore by an electric cable, and on October 23, 1885, the tower was accepted by the Government.

This is, I believe, the first light-house erected at a long distance from land which does not rest on a rock foundation.

[To be continued.]

THE ILLUSTRATIONS

[*Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.*]

HOUSES ON WALNUT STREET, BROOKLINE, MASS. MR. H. I. COBB, ARCHITECT, CHICAGO, ILL.

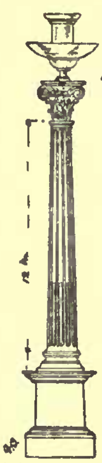
[Gelatine Print, issued only with the Imperial Edition.]

TWELVE COMPETITIVE DESIGNS FOR THE FACADE OF MILAN CATHEDRAL.

[Issued only with the Imperial Edition.]

THESE prints are reproduced from the special edition of *L' Illustrazione Italiana* of September 11 which gives a full and thoroughly illustrated description of the competition and of the cathedral itself.

OLD COLONIAL WORK IN THE SOUTH, NO. II. — GADSBY TAVERN, MEASURED AND DRAWN BY MR. GLENN BROWN, ARCHITECT, WASHINGTON, D. C.



A Manogany Candlestick.

A Lesser Light of Washington Lodge used at the Funeral of George Washington.

IN this building are found many items of interest both from an architectural and a historical standpoint. It was erected in 1793 when Alexandria was a flourishing town, probably one of the most prosperous in the country. It was built by John Wise, a noted tavern keeper in those days. The announcement of the opening of this hotel may still be seen in a *Virginia Gazette* of 1793.[1] Here the most prominent people of the day were feasted and fêted. In 1796 a banquet was given there by the Alexandria Washington Lodge of Masons. It was also a favorite place for assemblies, or balls, as we should call them now. A book called "*The Lodge of Washington*" tells us that at a ball given at the Gadsby Tavern on the 22d of February, 1798, Washington participated by his presence in celebrating his own birthday. A portion of the musician's gallery in this ball-room is shown in the plate. This gallery is not supported by posts from the floor where they would interfere with the danceers, but is hung from the ceiling.

Alexandria was probably the first place to celebrate Washington's birthday. The ceremonies usually consisted of a parade by the military and a birthnight ball. Assemblies were given regularly by the Washington Society of Alexandria, "attended by the beauty and fashion of the town." The following autograph letter is still preserved in the Lodge rooms:

MOUNT VERNON, 12 Nov., 1799.

Gentlemen:

Mrs. Washington and I have been honored with your polite invitation to the Assemblies in Alexandria this winter, thank you for this mark of your attention. But alas! our dancing days are no more. We wish, however, all those who relish so agreeable and innocent an amusement all the pleasure the season will afford them.

Your most obedient and obliged humble servant

GO. WASHINGTON.

GEO. DENEALE
WILLIAM NEWTON
ROBERT YOUNG — *Managers.*
CHAS. ALEXANDER
JAMES H. HOOE

The rooms where the Alexandria Assemblies held their meetings are now a part of what is known as the City Hotel, and they were built some years before the portion known as Gadsby's Tavern, probably about 1780. The interior doorway on the plate is taken from this portion of the building.

[1] Advertisement from the *Virginia Gazette* and *Commercial Advertiser*.
"City Tavern,
"Sign of the Bunch of Grapes.
"The Subscriber informs his customers * * * that he has removed * * * to his new and elegant three-story brick house * * * which was built for a tavern and has twenty commodious and well-furnished rooms in it, where he has laid in a large stock of good old liquors and hopes he will be able to give satisfaction to all who will favor him with their custom JOHN WISE.
"ALEXANDRIA, VA., February 6, 1793."



Heliotype Printing Co. Boston.

"Sagrario Metropolitano" or Parish Church of Mexico

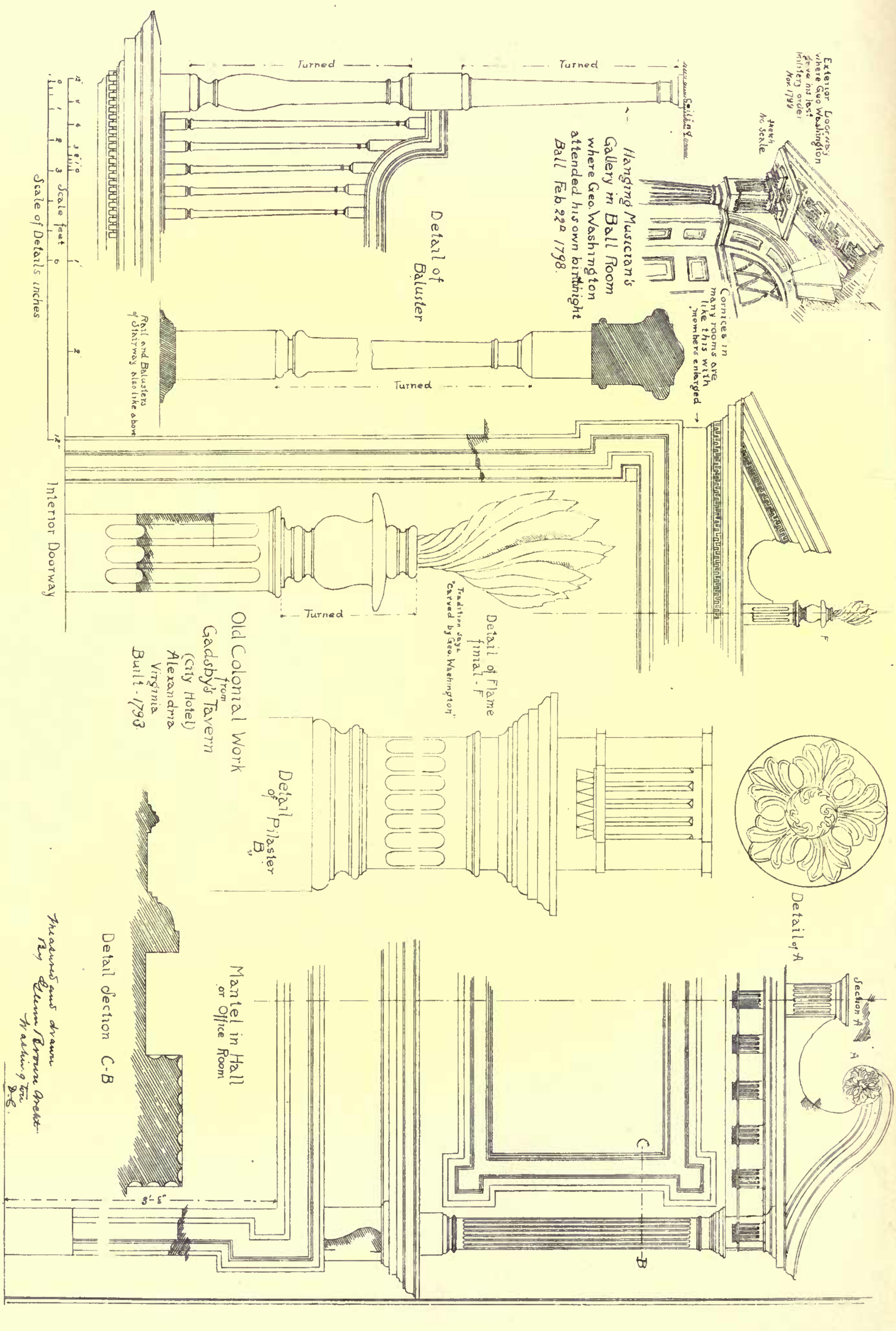


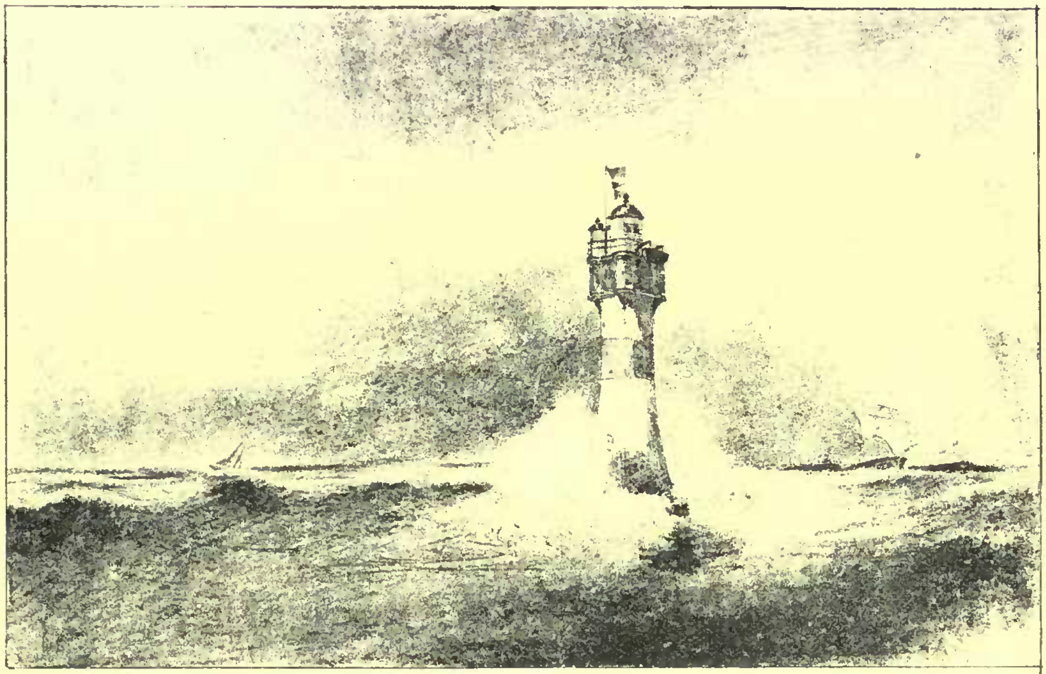
GEORGE · F · HAMMOND · ARCHITECT ·

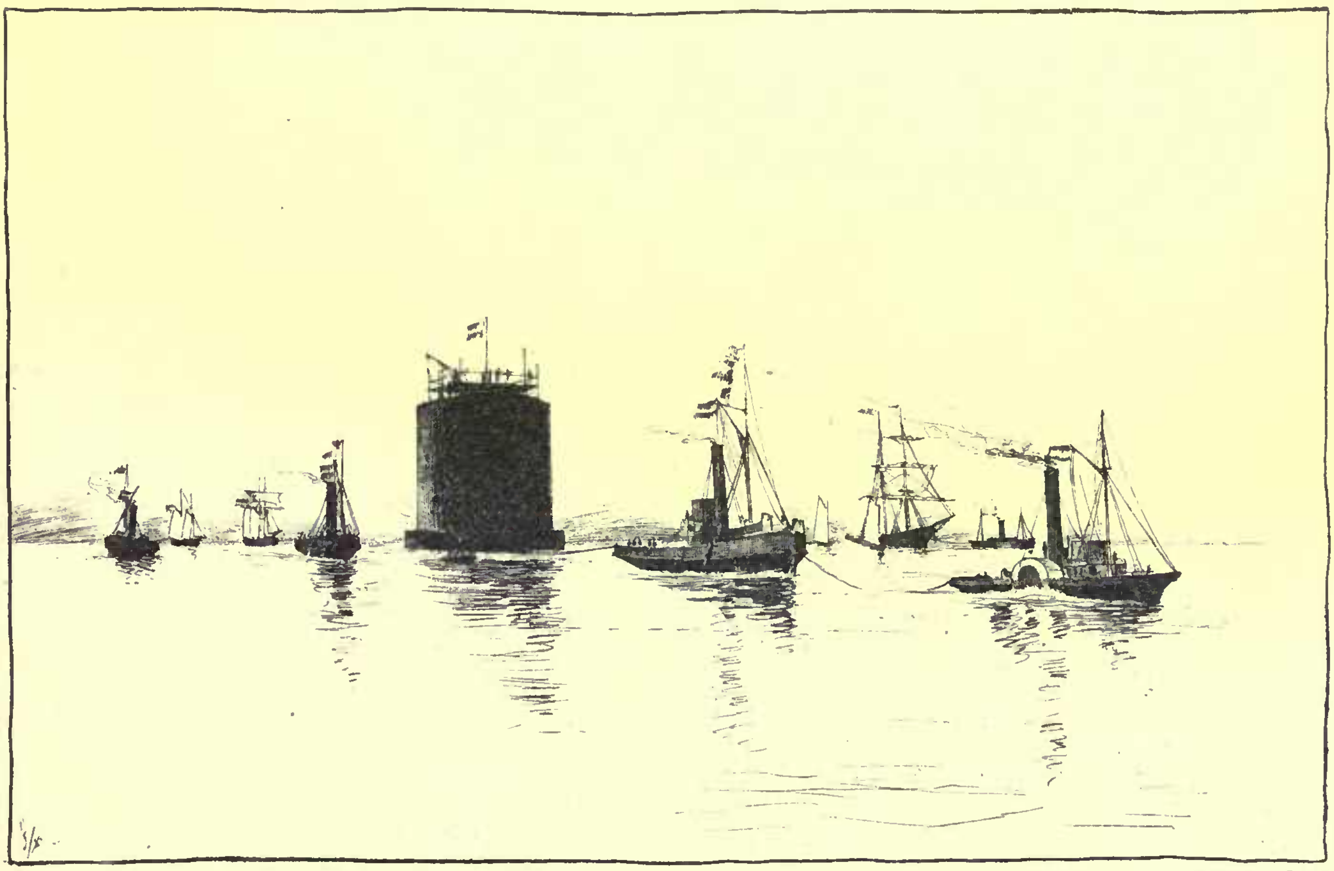
Heliotype Printing Co. Boston.

THE HOTEL HOLLENDEN

CLEVELAND, OHIO

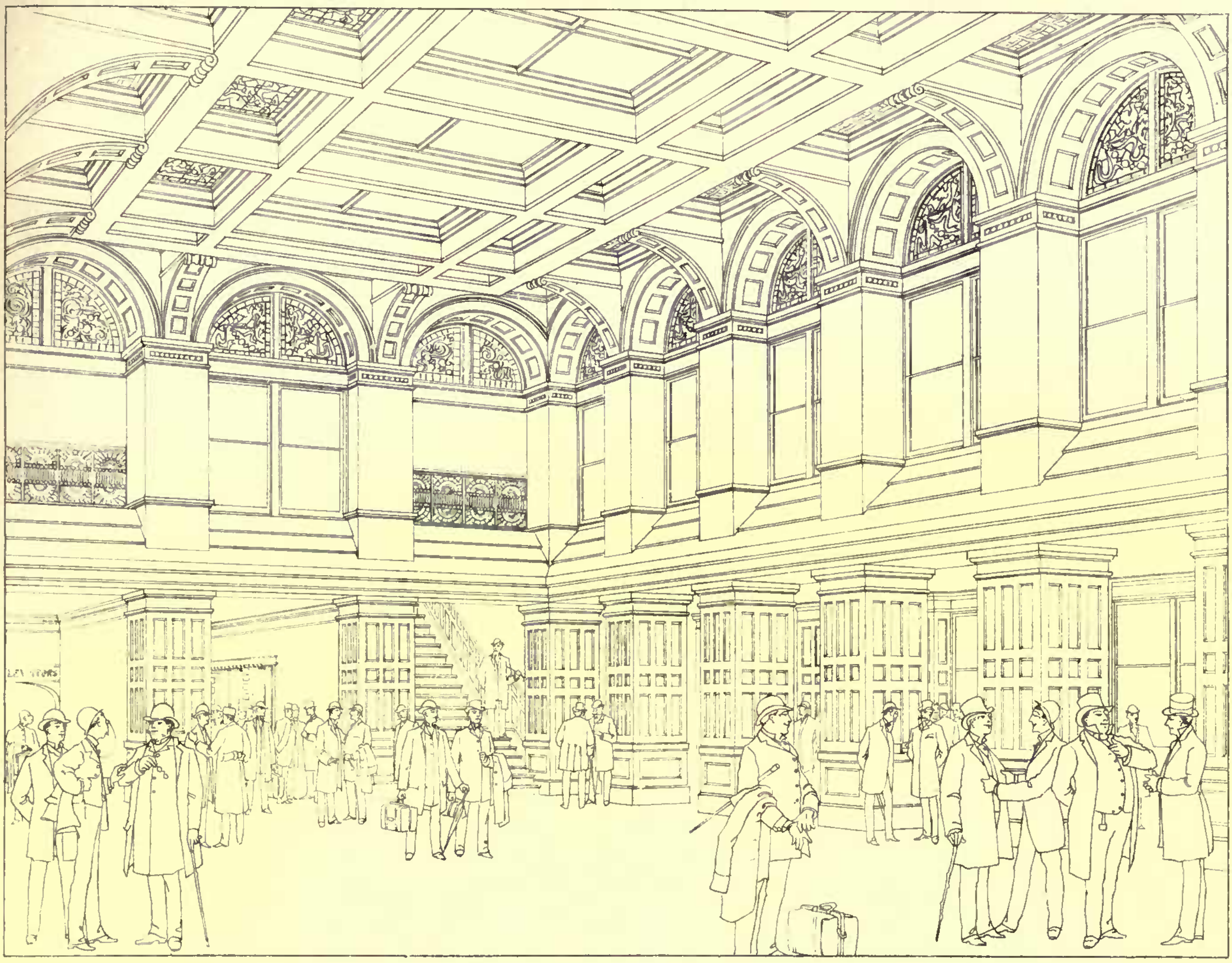

Exterior Doorway where Geo. Washington gave his last Military order Nov. 1799
Sketch No Scale
Hanging Musician's Gallery in Ball Room where Geo. Washington attended his own birthnight Ball Feb 22d 1798.
Turned
Turned
Ceiling
Detail of Baluster
Scale feet
Scale of Details inches
Rail and Balusters of Stairway also like above
Turned
Cornices in many rooms are like this with members enlarged
Interior Doorway
Turned
Tradition says "Carved by Geo. Washington"
Detail of Flame finial - F
F
Old Colonial Work from Gadsby's Tavern (City Hotel) Alexandria Virginia Built 1793
Detail of Pilaster "B"
Detail of A
Section A
A
Mantel in Hall or Office Room
Detail Section C-B
C
B
3'-5"
Measured and drawn by Glenn Brown Arch't Washington D.C.
·OLD·COLONIAL·WORK·IN·THE·SOUTH·



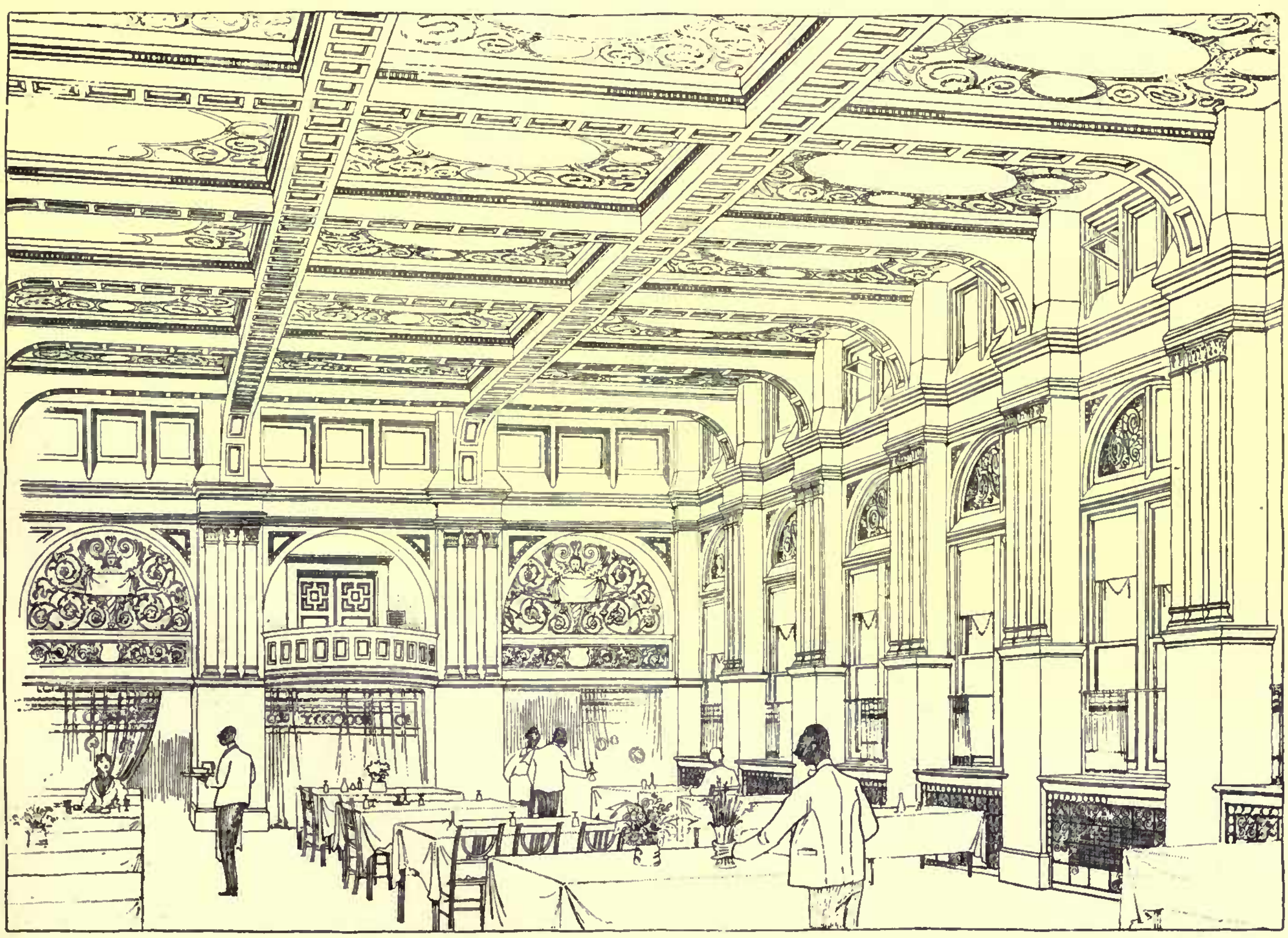


Heliotype Printing Co. Boston

The Rothersand Lighthouse



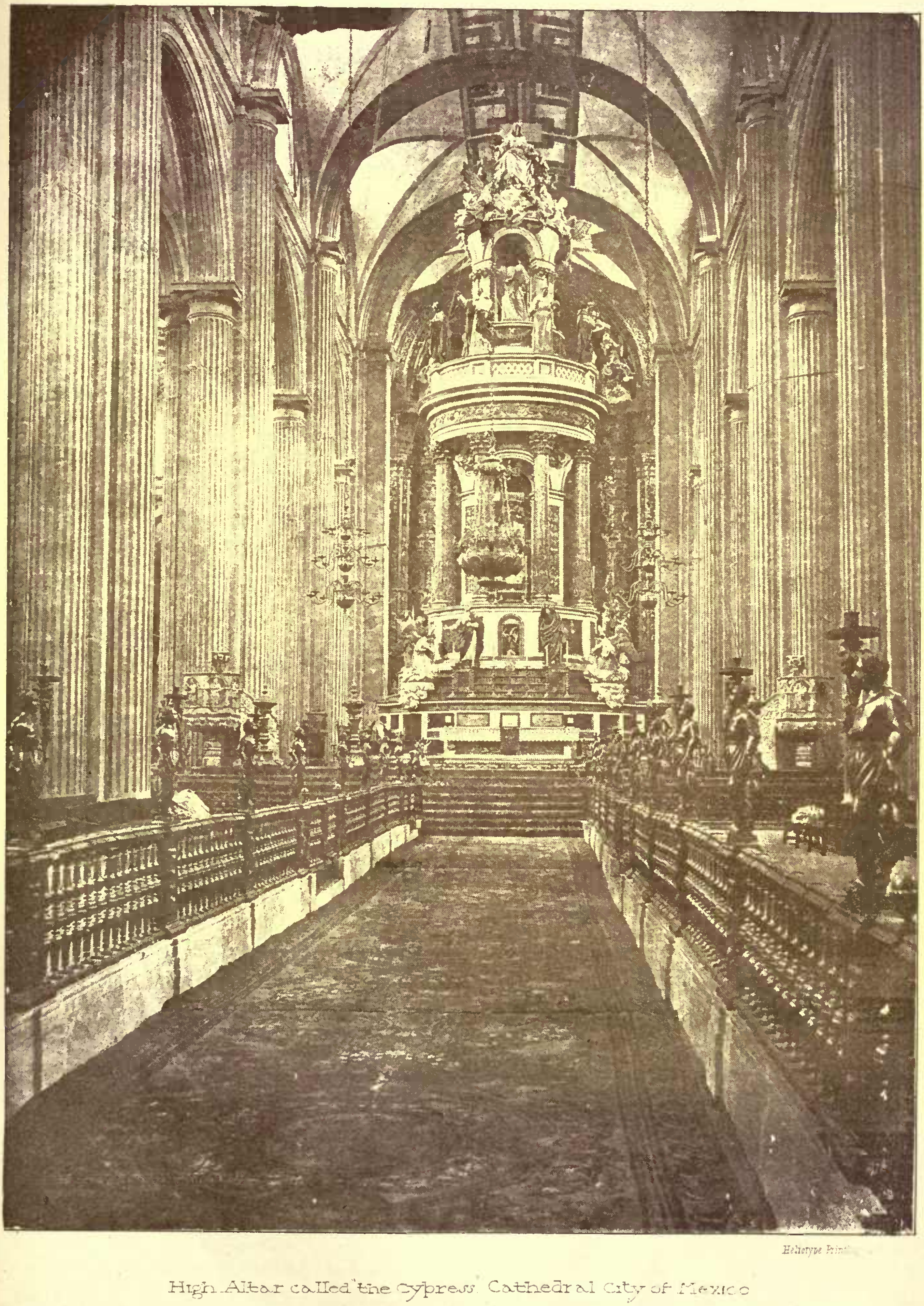
THE OFFICE —— THE DINING ROOM



Heliotype Printing Co. Boston.

HOTEL HOLLENDEN, CLEVELAND, O.

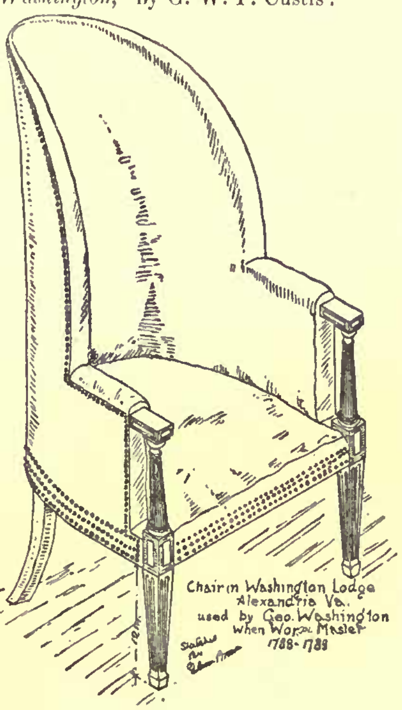
GEORGE F HAMMOND ARCHITECT



Heliotype Print.

High Altar called "the Cypress" Cathedral City of Mexico

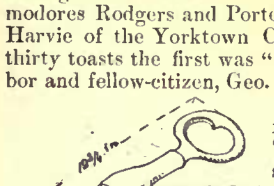
I quote the following bit of history in connection with this hotel from the "*Recollections of Washington*," by G. W. P. Custis:



"It was in November of the last days, that the General visited Alexandria upon business and dined with a few friends at the City Hotel, Gadsby, the most accomplished of hosts, requested the General's orders for dinner, promising that there was a good store of canvas-back ducks in the larder. 'Very good, Sir' replied the chief 'give us some of them with a chafing-dish, some hominy, and a bottle of good madeira, and we shall not complain.'

"No sooner was it known in town that the General would stay to dinner than the cry was for the parade of a new company called the Independent Blues, commanded by Captain Piercy, an officer of the Revolution. The merchant closed his books, the mechanic laid by his tools, the drum and fife went merrily round, and in the least possible time the Blues had fallen into their ranks and were in full march for headquarters.

"Meanwhile the General had dined and given his only toast 'All our friends' and finished his last glass of wine, when an officer of the Blues was introduced who requested, in the name of Captain Piercy, that the Commander-in-chief would do the Blues the honor to witness a parade of the corps. The General consented and repaired to the door of the hotel looking toward the public square, accompanied by Colonel Fitzgerald, Dr. Craik, and Mr. Herbert, and several other gentlemen. [This doorway was removed a few years ago from its original position and put up at a back entrance. See plate.] The troop went through many evolutions with great spirit and concluded by firing several volleys. When the parade was ended the General ordered the author of these recollections to go to Captain Piercy and express to him the gratification which he, the General, experienced in the very correct and soldierly evolutions, marchings, and firings of the Independent Blues. Such commendation from such a source, it may well be supposed was received with no small delight by the young soldiers who marched off in fine spirits, and were soon afterwards dismissed. This was the last military order issued in person by the father of his country." The next historical event of interest connected with this house was the banquet to Lafayette by the citizens of Alexandria on his visit to this country in October, 1824. On his visit he brought his son, Geo. Washington Lafayette, with him. He was met by a long procession of citizens, old soldiers carrying old artillery and relics of Washington and the Revolution, all fully described in the *Alexandria Gazette* of Oct. 19th, 1824. Robert E. Lee, then a boy, was a marshal in this procession. The hotel's name was changed for the third time, at this date being called Claggett's Tavern, from its host. "About five o'clock the General [Lafayette] attended the public dinner at Claggett's Tavern, at which were present many distinguished gentlemen, among others the Hon. John Quincy Adams, Secretary of State, Commodores Rodgers and Porter, General Macomb, Colonels Peyton and Harvie of the Yorktown Committee, and several others." Among thirty toasts the first was "The memory of our late illustrious neighbor and fellow-citizen, Geo. Washington." On the 21st of February, 1825, the lodge of Washington gave Lafayette a masonic banquet at this hotel. The members present, the songs they sang, the toasts they drank, the speeches they made, are all recorded in the lodge of Washington. Lafayette's toast was, "Greece, let us help each other."



To within the last ten years this building was used as a hotel, under the name of the City Hotel. At present it is used as an auction-house and storage warehouse by R. T. Lucas. I am indebted to the records of Alexandria Washington Lodge No. 22, for many of the facts mentioned as well as the privilege of making the sketches of relics of Washington, which I shall use as initial cuts in this and other articles.

GLENN BROWN.

ROTHERSAND LIGHT-HOUSE. TOWING THE CAISSON.

For description see article on "Ancient and Modern Light-houses" elsewhere in this issue.

FRONT OF THE SAGRARIO METROPOLITANO, OR PARISH CHURCH, MEXICO, MEX.

For description, see article elsewhere in this article.

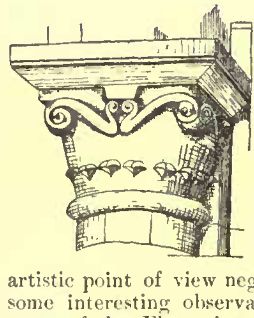
THE HIGH ALTAR, CALLED "THE CYPRESS," IN THE CATHEDRAL, MEXICO, MEX.

THE HOTEL HOLLENDEN, CLEVELAND, O. MR. GEORGE F. HAMMOND, ARCHITECT, CLEVELAND, O.

DINING-ROOM AND OFFICE OF THE SAME.

SANTA MARIA DEL FIORE, FLORENCE.

FLORENCE, October 7, 1887.



IT is not too late to speak of the fêtes which took place lately at Florence on the occasion of the unveiling of the façade of Santa Maria del Fiore. It is, you all well know, one of the, if not *the*, finest monuments of the Italian Renaissance. The published accounts of this grand artistic event only contain details of the episodes attending it, and present a purely descriptive picture of the ceremonies and public rejoicings for which the ancient city of the Medici served as theatre. But from the artistic point of view neglect has been shown in bringing into relief some interesting observations. In place of telling over again the story of the Florentine fêtes, which the immense city was hardly large enough to contain, I will stop by preference at reflections likely to be of interest to those who concern themselves with matters of art and their story.

First, I must mention a very local and very Italian phenomenon, or rather very Florentine. I mean the intelligent eagerness and the ardent enthusiasm with which the population of Florence and its environs associated together for this artistic solemnity. The people of this part of the peninsula are certainly more polished and better educated than those of other parts of Italy. The Piedmontese is full of urbanity and obligingness but the spirit of discipline accounts for much in his customs. The Milanese is well instructed and laborious, the Venitian is frivolous and jesting, the Genoese is hardy and enterprising, the Roman is hospitable and witty, the Neapolitan is impassioned and imaginative, the Florentine, however, is lovable and poetic in taste as well as by nature, and seems to have received from the Etruscans, his ancestors, the cultivation and fine manners of the Athenians. We recognize in them that artist race which wished to be free to gather riches and accumulate treasures only in order to consecrate them to the erection of monuments which to-day bear witness to its vanished grandeur. The ancient Republican city has preserved its classical edileship; nothing, or almost nothing, is changed in its magnificent appearance, so much does it still bear the stamp of exquisite grace, which recalls the fairest ages of art. The Place de la Seigneurie, where were discussed matters of interest to the public, and the *parvis* of Santa Maria del Fiore, where, during the hours of leisure, the merchants and bankers who used to lend their sequins to the kings of England were wont to collect and discuss questions of philosophy and æsthetics, have not ceased to be the two converging points to which flow the daily movement of the city. Without change of costumes, there only needs a little imagination to renew, as by enchantment, the scenes of those times when the furor of the factions and the love of art agitated this nation of lettered manufacturers, — when the Florentine people, after having wasted its forces in civil warfare, retired within itself in order to dream under the portico of its magnificent cathedral, just as the Athenians used to rest themselves from their rude labors and intestinal dissensions under the shadow of the Parthenon.

Those who deny the beneficient influence exerted by Catholicism upon the work of the mind ill understand the history of Italy, which has been the cradle of the arts. At Florence, at least, it is certain that if the papacy had been vanquished in the fourteenth and fifteenth centuries, and if the Puritanism of Savonarola had obtained the upper hand, the Renaissance would have been stifled at its birth. We know what a hatred this great man nourished against painting and sculpture, which he considered as accursed, and opposed to the spirit of true religion. If it had rested with him, a colossal *auto da fé* would have been made with all the treasures of Italian genius, which, according to the morose monk, imprinted on Christianity a character of worldliness contrary to its essence; in which the figures of the divinity were represented, according to him, under aspects far too sensual and too humanlike. Michael Angelo, who entertained for the Dominican of St. Mark a filial veneration, and who placed him among the elect in one of his frescoes, "The Universal Judgment," did not imagine that his idol felt only dislike for art.

The triumphant rigor would have arrested the upward movement of Italian genius, renewing its life after a long period of inanition; and when, after the death of Leo X, who had endowed his pontificate with an immortal éclat, there was, on the part of some of the Roman cardinals a movement or reaction against the gentle and elegant costumes introduced into the Court of Rome by the Florentine Popes, extreme rigorism came very near taking its revenge. Chance had brought to the chair of St. Peter a Flemish pope who had, until

then, lived the silent and austere life of the cloister, and who, praying and believing, after the manner of the Christians of the early centuries, had a terror of the unwholesome influence which the sumptuous splendor of the arts could pour out upon the future of Catholicism.

Adrian VI seemed to be highly scandalized by the portions of the Sixtine Chapel painted by Buonarotti, which, he said, looked more like the main room of a public bath than the vault of a church. He covered his face in token of his repulsion at the sight of the Laocoön, and cried out, "*Sunt idola antiquorum.*" This pope had come from too great a distance to appreciate that the ancient city of the Cæsars, besides being the centre of the Catholic world, ought also to rise to the rank of the capital of the arts and sciences and of genius, and that it was by way of paying homage to triumphant religion that it clothed itself with an incomparable splendor. One thing is certain, that is, that the papacy preserved the arts in Italy; and that if the Ghibellines, imbued with the spirit of Savonarola, had gained the victory, the Italian nation would never have known the grand artists of whom it is to-day so justly proud. Across the cruel vicissitudes of its history the Tuscan people were able to preserve the courtesy and distinguished manners which were due to their artistic education. They still preserve a very lively passion for everything which is fair and agreeable.

One should have seen the crowd that hurried from every part of Tuscany to gather about the cathedral on the day of the unveiling of the façade. One would have surmised that it had not been brought together only by motives of commonplace curiosity. The cult of the arts is of such age in this country that little by little it has become endemic, and has spread through all classes of people. It has flashed into the suburbs, so that the most modest farmer and the most humble bourgeois know how to feel the impassioned admiration for a statue or a monument. Every question of art is here a matter of public interest, and the columns of your journal have doubtless related in what fashion the dissension which raged some time ago in the city on the subject of the façade of Santa Maria del Fiore was finally settled.

You have not forgotten that the construction of this church, commenced toward the end of the thirteenth century, after the designs of Arnolfo di Lapo, was interrupted by the death of the architect. Later, Brunelleschi added to it the magnificent dome which crowns so worthily the rear portion; but the façade remained unfinished up to the formation of the kingdom of Italy, although several great artists, amongst others Giotto and Andrea del Sarto, had been charged at different times with filling the void. Immediately on the annexation of Tuscany to Piedmont, the king, Victor-Emmanuel, signed a decree authorizing a competition, and from this time dates the conflict which arose over the style which should be adopted for the completion of this work — a conflict which lasted more than twenty years.

Some maintained that the façade ought to be completed in the tricuspidal style, which finishes the façade with three gables. Others, on the contrary, contended for the basilical style, which is composed in the main only of one low gable, as is seen in most of the Greek and Roman basilicas. It was easy to indefinitely prolong this discussion, for amongst the drawings left by Arnolfo, the one for the façade was not discovered, so that it was not possible to know what was the architect's own idea as to the style in which the unfinished portion of the church should be completed. To put an end to the discords thus provoked, and over which the entire population got itself into a ferment, the Government decided to submit the question to the suffrage of the people. Therefore, there were set before the people *fac-similes* of two façades constructed in these two opposing styles; and the inhabitants pronounced in favor of the basilical style by a solemn vote. Could not one believe these things took place at Athens on seeing the doctrine of the appeal to the popular will thus applied to matters of art? So far as the manner in which was settled the architectural problem which had remained in suspense since the death of Arnolfo di Lapo, there ought, perhaps, to be formulated some reservations, and we ought to wait until the first impression has faded away before forming a judgment in cold blood. In my opinion much haste has been shown in proclaiming throughout Italy that the work executed at Florence by the architect De Fabris, the winner of the royal competition, is the architectural *chef d'œuvre* of this century, which has transformed Santa Maria del Fiore into the most beautiful monument in the world.

So far as execution goes, the new façade leaves nothing to be desired. The marble of which it is built is hewn, cut and chiselled with an incomparable ability, and the colors are arranged with irreproachable good taste. Certain of the details are executed with a delicacy and precision which are astonishing. Amongst the statues which ornament pilasters or which crown pinnacles there are some of striking beauty, and one may say that all the ornamental parts have been treated in a most masterly way. The mosaics which ornament the tympana of the three arches are most happy in their reserve, and indicate a definite renaissance of the mosaicist's art, which our ignorance of the methods employed by the Greeks, our masters in this art, had allowed to fall into desuetude for a long time past. To-day, thanks to the precious discoveries of Sig. Salviati, we can reproduce in mosaic the most complicated pictures, can render all the contrasts of chiaroscuro and all the delicacies of drawing, and expose the work to the air and sunlight for ages without fear that they shall ever undergo any alteration.

The sentiment of admiration which the new façade inspires, considered as a piece of modern work, apart from the edifice which it was designed to complete, can warrant only few criticisms, if one were disposed to make them. I would only criticise, if I dared, some few bits of relief placed here and there to soften the asperities of the design, and notably one figure of Christ, reclining with crossed arms upon a plate arranged obliquely at the top of a tabernacle, in such fashion that the image of the Saviour, presented in this attitude in the middle of a disc, awakens vaguely the suggestion of a spitted human pigeon. It is grotesque and unpleasant, and this *bizarre* manner of exhibiting the son of Mary, who is enthroned, queen-like, in the centre of the façade, shocks the spectator, and casts a discordant note into this marble poem where everything ought to contribute to the glorification of the religious sentiment which hovers about the building. In any event, in order to judge impartially of the character and value of Sig. De Fabris's design, one must resolutely lay aside the pleasing impressions which are produced by the brilliancy of the marbles, the skilful minglings of shadows, the luxury of ornament, the profusion of the statues, and the effulgent splendor which bursts from this vast work of architecture, which, all glorious, has just left the hands of the sculptors. There are about it seductive elements against which one must be forewarned. When at length one has succeeded in getting on his guard against this deceitful though very natural impression, one feels that the façade of Santa Maria del Fiore has, before everything, the grave fault of not being conceived in any definite style, and of being rather the result of a compromise between opposing tendencies. Sig. De Fabris had first conceived his design in the tricuspidal spirit which belongs to the Italian Gothic, and of which the Cathedrals of Siena and Orvieto offer the most perfect models, for his design had been brought into shape before the *plébiscite* of which I have just spoken. Death overtook him during the progress of the work, and then his adversaries took their revenge and succeeded in obtaining sanction for the style which he had repudiated; so that the façade, which had been commenced in a style dear to the dead architect, was finished in that to which he was opposed. This strikes the eye at once, for the façade is tricuspidal at the base and basilical at the summit. The lower portion shows three arched doorways surmounted each by a tabernacle, the repetition of which at three different points marks an advance towards the tricuspidal style. Then all at once, as the eye is raised it meets abruptly the crowning line cut horizontally across, scarcely interrupted at the centre by the low gable, as was required by the law of the basilical school.

I am equally of the opinion that in its relations with the other portions of the building, the new façade is not beyond criticism. Arnolfo di Lapo, the architect of the Florentine basilica, knew how to fuse and appropriate for his own uses all the styles known at his time in Italy — Gothic, Greek, Arab, Byzantine, Moresque — and from this mixture he extracted a style of great individuality, which, without being composite, united all the graces, all the beauties and all the special features of the rest, although imitating no one of them.

The temple erected by Arnolfo is remarkable in the history of Italian architecture because of this; for one sees in it everywhere the effort of a genius which seeks to free itself from every foreign yoke, and aspires to create a style in which it can exercise its own temperament untrammelled. From the moment the question of completing the building came up, it was necessary to seek as much as possible the fundamental inspiration which had presided over its birth. Brunelleschi had not been wanting in this particular, and his dome, which yields to that of St. Peter only in the amplitude of its proportions, worthily crowns the rear portions of the monument, and is in perfect harmony with the general physiognomy of the building. Giotto, on the contrary, who constructed the square tower, planted at one side of the building facing the baptistery, in it created a cruel subject of embarrassment for whoever later should have to build the façade. This tower, of a heavy Gothic style, parades itself with a brutal indiscretion and by the discordance which exists between its massive breadth and the knowing and lightsome elegance of the nave of Arnolfo di Lapo, it seems a defiance launched at posterity by this great artist, who was in painting a precursor as revolutionary as Donatello was in sculpture.

The architect called upon to finish Santa Maria del Fiore was perforce condemned to struggle against two alternatives equally distressing, for he could not bring his work into accord with the campanile of Giotto without its swearing at the rest of the building, nor yet bring it into harmony with the general character of the Cathedral without finding itself in discord with the tower of Giotto. Only an architect of great genius could extricate himself from such an embarrassment by doing as Giotto did, that is to say, by giving free career to his imagination without occupying himself too much with his surroundings.

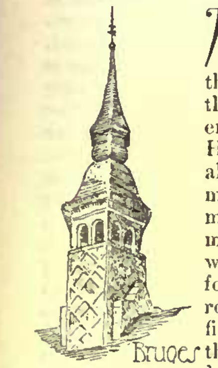
Sig. De Fabris was certainly endowed with a superior talent, but he lacked the boldness by right of which his talent could have been transformed into veritable genius. After struggling for a long time against these two alternatives which I have just mentioned, he finished by yielding, and allowed himself to be completely subjugated by the overpowering impression of the campanile of Giotto. His pencil glided in the direction of the style which characterizes this campanile, and his façade most unfortunately smacks of it.

It is, moreover, too heavy and too massive, and it accentuates in Gothic spirit the general physiognomy of the building which Arnolfo di Lapo endeavored to render as little Gothic as possible. It forms

thus a disavowal, a repudiation, an antagonism at which the spirit of Arnolfo di Lapo has just right to be offended. Once granted that every monument is an immortal book for whoever knows how to read between its lines, Sig. De Fabris has committed the same fault with which a writer could be accused who, being charged with writing the last lines of a very beautiful chapter of a volume, should apply himself to the task of making in this chapter a refutation of all the tendencies and sentiments which the author had developed in the preceding chapters.

Many of your readers, without doubt, will have the opportunity of verifying these observations. Italy is an obligatory stage for every traveller from the New World who comes to Europe, and of all the monuments which Italy possesses, Santa Maria del Fiore is perhaps the most interesting for all who wish to discover the beginnings of Italian architecture. I hope that those who may study this monument after having read this article, will recognize the justice and the impartiality of judgment which it expresses. H. MEREU.

THE TRAINING OF AN ARCHITECT.[1] — I.



AN architect ought to be familiar with *buildings and structure.* He ought to know all sorts of buildings, their various purposes, and how those purposes are provided for — all that makes them suitable and unsuitable for use, and for any emergencies for which they ought to be prepared. He ought to know structure also — that is to say, all the materials of which buildings are usually made, their appearance, qualities, defects — the marks of goodness or badness in them and the modes in which they are wrought, the work they will have to do in the structure, and their fitness for it. He ought te understood the sites and surroundings of buildings — drainage and sanitation fittings and appliances, and should have mastered the scientific principles upon which such things as heating, ventilation, lightning-conductors, and cooking-apparatus should be arranged, as well as their practical details. He has to understand the decay and disruption of buildings, and the risks of decay and accident that beset them, and how to guard against such risks. Again, an architect ought to know something about the history of buildings, and the most important structures in the world. He ought to know the artistic principles upon which good buildings have been designed, and the forms, mouldings, enrichments and features which have been to the great artists in architecture what the colors on his palette are to the painter. And he ought to know by personal knowledge and experience, by measuring and drawing out in some cases, and by sketching and noting in others, a considerable amount of good architecture and good ornament, some of which ought to be from other countries than our own. And with some of this architecture he ought to be familiarly, nay, intimately acquainted. Further, he requires to be at home upon buildings in course of construction, to foresee what is likely to be successful or otherwise, whether in arrangement, construction, or design; and to be able to correct defects and prevent mistakes, alike of design and of construction before it is too late.

Again, the architect is required to know *men and affairs* as well as building. You will come to find, as you advance in life, that in every professional calling, as, indeed in every important position in life, a knowledge of men is the most valuable of all acquisitions. Even the solitary student, or the lonely landscape-painter, works for others, and if he succeeds it is either because his mind is so in harmony with the thoughts of his time that he involuntarily produces what others delight in, or else because his powers of calculation and observation enable him to take the measure, so to speak, of the men of his generation, and cleverly to produce (possibly without sympathy) some work sufficiently in harmony with the time to please them. Far more is it the case with ourselves whose work is from first to last done in contact with our fellow creatures, that a knowledge of what men like and think and do is essential to success. The inception of any architectural undertaking grows out of the desire of other people to erect a building. The material carrying of it out is done by other hands than the architect's under the control of another head, often fuller of the desire to make money than to make a building; and the whole undertaking is beset by difficulties, emergencies and varied transactions, in which the architect has to unravel one tangled skein after another with different people. In short, from that early stage in his career, when an architect has to establish his position, make a connection, and inspire confidence sufficient to induce persons to put their work into his hands, to the close of the transaction, when the last instalment of his own fees is paid him, he has need of tact, resource, a command of temper, presence of mind, good common-sense, the ability to write a clear letter, and, in short, the qualities, natural and acquired, which enable a man to get on well with his fellow-men. All this must be combined with a knowledge of affairs. All this intercourse with other people rises out of matters that have relation to the buildings, or the site for them, or the materials of them, or the uses they are to be put to, the laws affecting them, or the customs, or the prejudices, or conflicting interests of the folk who have to deal with them. Now, in every one of these things the architect or chief builder, if he is to be chief, must be sufficiently posted up to take the lead. He must be familiar with such of the forms of transacting business, correspondence, accounts, vouchers, etc., as are used in building affairs, and such laws, customs, rights, as are incidents of or affect his work, and, in addition, with an infinite number of things that bear on it only indirectly. Estimates, accounts, the value of the things that are used in making buildings, the value of buildings themselves, and of the land they stand on. Road-making, repairs, light and air, the statute and common law as affecting buildings and property — on all these affairs he is expected to be able to give advice, and sound advice. He ought to know something about every use that a building can be put to, and though so much is almost unattainable, yet he ought to be constantly approaching to such a state of unusual knowledge of what goes on under all roofs the longer he lives.

Drawing and Art. — We build our buildings on paper to an extent never hitherto practised, but rendered apparently necessary by the modern contract system; but more than this, we study with the pencil when we examine existing work. The pencil aids to develop and fix our ideas when we are designing; with the pencil we make our intentions clear to our clients, and at a later period to the surveyors who prepare the estimate, and the artisans who carry out the work. Drawing, then, is a most essential — the most essential of acquisitions for an architect. The best draughtsman may possibly never make an architect, though I do not think such a result need often occur; but no architect can hope to succeed at the present time who does not draw well, and is not familiar with all that ought to be and habitually is done in drawing out architectural designs, plans, and details from first to last. Familiarity with plans is *not* a substitute for familiarity with building, but it is an admirable introduction to buildings, and the best possible aid to the mastering of them. The draughtsmanship that is necessary will extend beyond familiarity with plan-drawing. A good draughtsman must have so far mastered the use of the instruments as to be able to *think* through his bow-pencil or his straight-edge, and he must be able to draw all the ornaments in his buildings, including representations of the human figure, that his drawings shall be serviceable guides to the workmen. He ought to have mastered perspective, and to be at home to some extent in color. Finally, in the use of these means, he should have the feeling and inspiration of an artist, and he should have sympathy with and a knowledge of other walks of art as well as his own. Art which I have named last, on the principle on which the most famous performer is placed at the foot of a play-bill ("*and* Adelina Patti," for example), is that which determines the level at which our architect shall work.

If he can be the artist in feeling and training, and in what he designs, his work may be noble architecture, and certainly will be good. Being an artist, be it remembered, relates to everything that develops a sense of beauty in form, line, and color, and in all the allied parts as well as in our own. I need hardly point out that this considerable range of knowledge and experience will take years to acquire — in fact, it is the work of a lifetime; but what we are concerned with is that approach to it which justifies a beginning. This ideal portrait is not often, however,— even if time enough be taken, — carried out symmetrically and completely. Opportunity enables a man to accumulate experience, knowledge and skill in one direction. The lack of opportunity, or of will, or taste, cramps him in another; and so it comes to pass that most men are better in one walk of the profession than in another — fortunate if they are able to find that class of work for which they are most fit. In passing, I ought to point out that more than one of the matters that figured in our enumeration of the cultivated man's acquisitions or methods are almost essential to the architect. This is especially the case with his drawing and his cultivation of the fine arts. He, almost alone of all professional men, should, as a matter of course, include foreign travel as a part of his training. He also, in common with all professional men, should cultivate his mind and powers by Bacon's method of reading, writing, and social intercourse. In short, he should be a cultivated man. I now turn to the standard which has been set up by the Royal Institute of British Architects as marking what they consider should be the attainments of a young architect before he is admitted as an Associate of that body. This standard we find set forth in the programme of the examination and in the specimen examination papers published, and though my statement is in less detail than the series of subjects of examination, you will find that those subjects group themse.ves under my broader headings perfectly well. My first heading is "Buildings." To the subjects which I embraced under this head the programme allots 400 out of the total of 700 marks, divided as under: History of architecture, 100; mouldings, features, and ornaments, 100; sanitary science, strength of materials, and shoring, 100; materials and construction, 100. You see that the largest demands, even when a deduction, which I shall come to directly, has been allowed, are made under this head. This is partly on account of the fundamental importance of a knowledge of buildings, and partly because fair opportunities for acquiring that knowledge are open to you in your student days. My second head was "Men and Affairs." This comprises two heads in the examination programme, between which 100 marks are allotted. They are: Specifications and estimating, 75; professional practice, 25. The first of these two subjects most students can easily acquire, and skill

[1] A lecture by Prof. Roger Smith before the architectural class, University College, London.

in it can be readily tested by examinations; but much of the knowledge comprised under the head of professional practice cannot be acquired till later in life, so but few marks are allotted to the subject; moreover, the skill, tact, self-possession, and judgment needed for the transaction of business are not matters in which a candidate can be directly examined; though, as far as they come out in his *vivâ voce* examination, they will be sure to have a share in examining the result.

My third head, "Drawing and Art," is directly represented by one heading only, Plan, Section and Elevation, to which two hundred marks are allotted. Of course a proportion which the programme does not disclose of the marks allotted to the first group of subjects will be given to the sketches with which the answers are to be illustrated, and, as far as they go, these marks will increase the proportion devoted to drawing and art at the expense of those devoted to knowledge of buildings; but it is not likely that this could ever take place to so great an extent as to equalize the two. This examination grows, as you know, out of the voluntary examination, which acted as a pioneer to prepare the way. I had the honor of having some share in preparing the preliminaries of that examination, and am, alas! the only survivor of the five who acted as examiners and moderators on the first occasion, the others being Scott, Digby Wyatt, Ashpitel and John Papworth. Some of those who organized and subsequently recast the scheme still remain — among them, I am happy to say, my immediate predecessor in this class, Professor Hayter Lewis, to whose initiation as Honorary Secretary to the Institute, more than to the action of any other person, we owe it that to-day we have an entrance examination for Associates of the Institute. The advantages which it was considered that students would obtain were, first, that the programme would make it clear what directions, in the opinion of persons qualified to judge, an architect's studies and his preparation for the serious work of his profession ought to take; and, secondly, that the examination itself would establish a standard of attainment which it is not unreasonable to expect that every student with the usual means of study at command shall reach before he looks upon himself as qualified to practice.

The Institute by adopting this examination as the door through which every Associate must enter, had in one sense doubled the value of it, for it had added a double stimulus to work. Passing has always been a distinction; but now failure to pass entails a very serious professional disability. Of all things I should deprecate — and I think in this I should speak the feelings of the examiners and Council generally — I should deprecate this examination being looked upon, or coming at any future day to be looked upon, as an arbitrary test. It is intended to be, and I think is so worked by the Board who undertake it, as really to be a test of qualification. That is to say, a man is not held fit to be admitted to the Institute because he has passed the examination, but because he has fitted himself to perform the duties of an architect, and the examiners will direct their questions so as to satisfy themselves of this fact only. Whenever, or if ever, the examination fails to keep up its character in this respect, if it admits what are called catch-questions, and sinks to the level, for example, of the Civil Service examinations, where a man is passed as a consequence of his having temporarily worked up certain subjects, it will fail of its real object. Consider, then, that your duty really is to prepare yourself for practice, and that this examination is an incident in such preparation. And do not consider that you are to prepare yourselves for examination, and that if you can worry through you are sure to be right as far as fitness for your professional life goes.

If we have now arrived at some clear understanding of what you require to prepare you for practice, the only questions which it remains for me to deal with are first, the broad question of how generally you are to obtain it, and the narrower one of how much of it you can get here from me? I am not going to delay you in order at any length to examine any scheme of architectural education not at present in actual force, and within reach. Such an examination you will find in the reports in the professional papers of the Conference on Education held in May last. I should, however, like to refer, before I pass from the subject, to the programme of instruction in several of the American colleges, which, through the kindness of Mr. Cates, have been brought under the notice of many architects. In these programmes a course of scientific instruction is in each case provided, lasting several years, and taking in its turn history and draughtsmanship; but without enough attempt, so far as I can see, at securing for the student any familiarity with buildings. I trust that if these are seriously examined as precedents, it will be by the help of the light thrown upon them by observations from the pen of Mr. Wace appended to them. The American schemes appear to me too theoretical, not artistic enough, and in other ways not suited as models for an English course of architecture, should such a course come to be established, as is very probable. It will be even less necessary to raise the question of technical education for artisans, which is one of the most important ones of the present day.

The subject before us to-night is, it is true, to a great extent, a branch of technical education, for it relates to the education of the architect for the exercise of his art, and time will not serve us to travel outside its limits. I propose to pass at once now to the question of how, with the opportunities that London at present offers, you can be educated for your profession? Even that stage of preparation which the Institute examination marks cannot be reached without *time.* To become a great architect is the labor of half a lifetime. We have, however, had great architects in this country, and have them now; so it is clear that whether our appliances and methods are the very best or not, at least they *can* suffice. I once heard one of the greatest of modern water-colorists exclaim, before a gathering of artists, "It is not the water in the brush, but the spirit in the man that makes a painter in water-colors!" This is quite true; and if we take any great architect — say, Sir Charles Barry — it was the spirit in the man that made him what he was; still, the water-colorist does have water in his brush, and Barry reached his eminence by some path. Let us turn to the published memoir of him, and ask what was that path? Pupilage for a long term, travel for a long term, and then continuous effort — first to obtain, and then to carry out, responsible practice — is the answer that we shall obtain. Now, that simple programme will form the outline of the only course at present open to the architectural student of the present day, and I recommend both parts of it to your cordial adoption, not necessarily as the best possible programme — on that I offer no opinion here — but as the best possible in London in the year 1887; and I will endeavor to show how much pupilage and travel themselves can do for you, and what can be done to fill out, add to, and supplement these two cardinal elements. With or without sound preliminary training, let us suppose that the student begins his career as a pupil. The life of Barry tells us that he was articled for and worked out seven years. This is not perhaps too long for a man to work at the drawing-board, but it is too long to be in one place. The term now fashionable is three years, which is too short, and I believe that, as a rule, four years is a very useful term, and that then most men had better change, and spend two other years seeing the practice of other offices as assistants, and, as a rule, as paid assistants. I have not much to suggest to pupils; but I ought to point out that what is really intended to be done for them is not to teach them as they were taught at school, but *to give them a chance.* In consideration of the premium he has paid, a young man who for a long time is more of a hindrance than a help is tolerated in a place where the work would go on better without him, and it is an understood thing that he is to be allowed opportunities of learning if he will use them. This — though it may not sound a very precious privilege — is really of far more value than most young men have the remotest idea of, and the great danger, especially for students who come straight from school and have not had the training in self-culture which college affords, is that the opportunities may not be properly made use of. Let me urge on the notice of any pupils who may hear me, half a dozen or so friendly hints: First, to consider no trifle beneath their notice; secondly, to recognize that to acquire habits of punctuality, order, the mode of conducting simple affairs, endorsing letters, conveying messages, etc., are all essential to their success in after-life as business men; thirdly, to do everything entrusted to them as well as they can, but as far as possible to secure the difficult jobs and pass the easy ones on to some one else; fourthly, to let nothing pass that they do not understand without extorting an explanation from some one; fifthly, to visit the buildings on hand and the builders' workshops whenever there is a chance; lastly, to make sketches and notes of every possible thing, insignificant or otherwise. A pupil who will spend his four years in the practice of this line of conduct will leave the office a good deal nearer being an architect then he entered it. It is, perhaps, right to add that though I may have given what does not seem a very brilliant account of pupilage, and though I am about to show that it must be supplemented somehow, I do not think that what it supplies can be got elsewhere.

So practical a pursuit as an architect's business can, I think, only be learned by taking part in the actual conduct of it, and, though many pupils would do better had they spent some time in preparatory study before being articled, I see no reasonable prospect of any system being introduced to supersede pupilage without great disadvantage. In the pupil's career I include any subsequent time spent in somewhat similar work, though under the name of an improver or assistant. A still more useful addition to a pupil's course is a time spent in a position somewhat analogous to that of a clerk-of-works, or as resident-assistant to a clerk-of-works, or as resident-draughtsman on some building. Naturally, this is a rare chance. Very few pupils of five or six years' standing, if any, are really fit to be of much service as clerks-of-works, but if they can in any capacity spend some time on a building, they will find opportunities for acquiring practical knowledge that are invaluable.

[To be continued.]

TESTING EXTERIOR STAINS.

SINCE the use of stains for exterior work became so general, several stains, some good and some bad, have appeared on the market so that a few points on estimating their comparative values may not be amiss.

The nose, and to a less degree, the eye, are admirable allies for this work, but unassisted are not infallible. The following is about the simplest method of testing:

1. Search for kerosene by warming and then noting the smell. Also, note the thinness and lack of covering-power which kerosene causes. Kerosene is simply a cheapener.

2. See how fine it brushes out on a smooth shingle. There should not be the slightest grit or any perceptible grains of pigment, the presence of which will prove that the coloring was mixed dry with the vehicle and was never ground fine.

3. Pour out some of the stain in a tumbler. If it begins to settle at once, except in the case of a chrome-yellow or green, it is made

as above stated, by mixing a dry paint with the vehicle, and therefore should be avoided.

A well-ground oil stain tested in this way held up a whole day, and a creosote stain a day and a half.

Of course, when debating between two stains it is best to try them side by side. In such a case the comparative color-strength may be determined by diluting equal quantities of both stains of about the same shade, with equal quantities of turpentine and then applying the diluted colors to wood and noting the depth of color. One part of stain to ten parts of turpentine is a good strength.

A wise precaution is to conceal the fact that the samples are for trial as the makers, so far as known, are mortal.

They should be bought by some one not known as an architect.

SOCIETIES

ARCHITECTURAL LEAGUE OF NEW YORK.

AT the last meeting of the Architectural League it was decided to select for the exhibition to be opened on December 19, a jury of five, of whom three were to be non-members of the League.

The jury selected is: Mr. Richard M. Hunt; Mr. Charles McKim; Mr. Augustus St. Gaudens; Mr. Edward H. Kendall; Mr. Clarence Luce. (The last two are League members.)

CHARLES I. BERG, *Secretary.*

COMMUNICATIONS

A CORRECTION.

BOSTON, November 12, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — In "Theatre Fires — Remedies," in eighth paragraph, fourth line, for "right lines" read "sight lines."

Yours truly, JOHN A. FOX, *Architect.*

THE EFFECT OF LIME AND CEMENT ON IRON.

CHICAGO, ILL., Nov. 7, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — In the current number of the *American Architect* mention is made of the use of salt to preserve cement-mortar from the bad effects of freezing. If there are no objections to its use, to offset these advantages, the information is of great value, except that no statement is made of the proper quantity of salt to use. Could you, in your next issue supply this omission? I have been told by a German contractor — a graduate from one of the European Polytechnic Schools — that it was customary in Germany to put salt into the holes bored through oak posts and columns as a preventive to decay; and from another source I have learned that salt in the brown plaster coat is resorted to in some parts of Canada in extremely cold weather, but this latter use of salt seems open to an objection from its well-known property of attracting and absorbing moisture and the danger of unsightly efflorescence. I do not know that this objection would really arise, as I have never tried it, and would be glad to hear from any one who has. I should also like to hear from any one who has had practical experience in the use of salt in cement-mortar, and as a preventive of decay. Also (while I am about it), from any one who has had practical reasons for believing that cement is more corrosive to iron or steel than lime-mortar, or the reverse, both of which assertions have been made, to my knowledge, by persons claiming to know. Respectfully,

O. J. PIERCE.

[THE question of the proportion of salt to use in mortar was answered in our last issue. We have never known salt to be used in the first coat of plastering mortar, and should think it would be likely to cause yellow stains in the finishing coat. In the last coat it would, perhaps, not be objectionable in our dry climate. As to the influence of cement and lime upon iron, we think it is well settled that ironwork buried in lime-mortar or in masonry laid in such mortar is preserved from rust; and iron ties in perfect condition have been taken from the interior of walls laid in lime-mortar which had been undisturbed for more than six hundred years. This preservation of the metal is due to the alkalinity of the lime by which acids, particularly carbonic acid dissolved in water, the great enemy of iron, are neutralized before they can attack the metal, and so effectual is the protection that in fireproof building it is still common to give exposed iron a coat of whitewash before painting it, in order that the lime may defend the metal against the action of the feebly acid carbonate of lead in the coats of paint put on subsequently. With masonry in cement the case is somewhat different. Although the cement has no acid or corrosive action, it is so feebly alkaline that it does not protect the metal effectually against the carbonic acid present in moist air, and iron in cement work exposed to moisture will rust. Singularly enough, both cement and lime, where water is present, will corrode lead, through a chemical action not as yet very clearly explained. — EDS. AMERICAN ARCHITECT.]

THE PROPER FEE FOR AN ARCHITECT COMPELLED TO ACT AS CONTRACTOR.

MONTGOMERY, ALA., November 9, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — In the case of the Wyandotte, Kansas, architect, I will give you my way of doing. I have to finish up several houses at this time in the very way he speaks of, left by defaulting contractors. And the only way to get at a proper compensation for my services in addition to my commission, as architect, is to charge so much for each day until the work is finished. I do not desire the position, but sometimes we can't get a contractor to take the work at a reasonable price, and then again we can't get a competent man to fill the place. That is the only way I know of. It seems to me to be the only way that it can be done to give all parties justice.

Yours truly, R. N. MCGRATH, *Architect.*

NOTES AND CLIPPINGS

ARTESIAN WELLS IN SOUTH AUSTRALIA. — Scarcely second in importance to the grand gold discovery is the success which has, during the past year, attended the operations of the Water Conservation Department. In the month of September a bore made by the diamond drill at the Hergott railway station, on the Great Northern line, which is being gradually extended across the continent, struck a strong spring at the depth of 348 feet. The water rose and flowed over the surface at the rate of about 3,600 gallons per hour, gradually increasing to 4,000 gallons. On pipes being fixed to convey it into the elevated tanks, placed at a height of 60 feet to supply the locomotives, the water rose to that height and flowed into the tanks. The supply still continues unabated. Shortly after this another bore was put down at Strangways Springs, about 65 miles northwest from Hergott. Here, at the depth of 308 feet a much stronger spring was struck, the water rising with considerable force in a fountain 9 feet in height, at the rate of 1,000,000 gallons per day. The surrounding country being flat, was soon flooded for miles around. Unfortunately, the presence of a small portion of magnesian salts in the water rendered it unfit for irrigation purposes. It has, however, since improved in this respect. A third bore in the same district, and about 25 miles distant from the former, and in a northerly direction, has also been successful. It should be stated that in these localities there were natural springs previous to the boring, but the supply of water from them was limited. The quality of the water is excellent, quite good for domestic use as well as for stock. The source of supply is supposed by geologists to be in the great dividing range on the southern part of Queensland, some 700 miles distant from the site of the bores. The rainfall on this range is enormous — 60 to 70 inches in the year — and it is supposed to percolate through the strata until it reaches a retentive stratum which appears to continue in the form of a huge basin for the distance mentioned. It is therefore considered probable that over this immense area artesian bores may be sunk with the certainty of success. Another most important discovery of water has been made in a part of the country more in need of it than those just mentioned. It is in the southwestern portion of the province, near the border of Western Australia, on the "Mellabar Plains," hitherto a waterless country, and having a limited rainfall. The bore was put down to the depth of 749 feet, when a spring of fine water was struck, which rose to within 150 feet of the surface. The benefit to the country resulting from these artesian wells will be very great. Another bore is now commenced a few miles further inland, in the southwest district. The Government is also very anxious to provide a supply of water for the diggings, and it is probable the drills may also be set to work in that locality, though the Conservation of Water does not think favorably of the prospects of deep boring there. In the settled districts a considerable amount of important work has been done in forming, repairing, and cleaning dams and reservoirs, in sinking wells and artesian bores in different parts of the country, with such successful results that provision has been made for a *daily* increase of consumption of 742,408,228 gallons. The expenditure of the department totaled £67,350. — *J. W. Smith, Consular Agent.*

PAINTING ON CEMENT. — According to the *Bulletin de la Ceramique*, it is known that the caustic lime which is not in a state of combination in cement saponifies the oil used in painting. Consequently painting on cement is only practicable when, under the influence of the air, carbonic acid has united with the caustic lime to form carbonate of lime. When it is desired to paint cement without delay, attempts are sometimes made to neutralize the lime by acids; but the above-named journal recommends in preference the use of carbonate of ammonia, the acid of which combines with the lime while the acid is liberated. The effect produced is, however, only superficial. Various other expedients are referred to, but the solution of the problem would seem to consist in the use of caseine. Fresh white cheese and slaked fat lime are added to the color. This mixture hardens rapidly, assumes the consistency of stone, and is insoluble in water, a formation of albuminate of lime taking place. It is according to this system that the mural paintings at the Berlin War Museum were executed.

To make the composition, three parts of cheese and one of slaked fat lime are stirred, the quantity of color to be added being regulated by practice. Only earth colors or oxides of iron would be used for light red to dark brown shades; for blue, ultra-marine or cobalt blue would be used; for white, oxide of zinc or sulphate of baryta; and for black, animal black. Inorganic colours, such as those of aniline, would not be used, nor would Prussian blue, vermilion, blue ochre, and white lead be employed, on account of the injurious effects of the sulphur present in the cheese in combination with these substances.

If he painting surface is too dry it can easily be damped. The caseous lime should be prepared daily, and the brushes should be cleaned after the application of each coat of paint. The process thus described is recommended for its economy, the walls of a house being painted as fast as the scaffolding is removed. The caseous paint does not easily take fire, and is therefore considered particularly suitable for the decoration of theatres, and for application to stage-carpenter's work generally.

The Ultimate Destination of Dr. Schliemann's Treasures. — Dr. Schliemann has made a will leaving his valuable collection at Athens to the Ethnological Museum at Berlin.

A Tower on the Mount of Olives. — The tower which is being erected by the Russians on the highest point of the Mount of Olives is already several stories high, but one more is to be added. The object is to make it so high that both the Mediterranean and the Dead Sea may be seen from the top. A number of bells will be placed in the tower. In digging the foundation several Christian graves were found, together with an inscription in Greek, in which the word "Stephanus" could yet be deciphered. — *Home Journal.*

A Twelfth-Century Bill. — An itemized bill of the twelfth century is old enough, in all conscience, but this one from the records of Winchester Cathedral, dated 1182, may be new to most people:

	s.	d.
For work done in soldering and repairing St. Joseph....	0	8
Cleaning and ornamenting the Holy Ghost..............	0	6
Repairing the Virgin Mary before and behind and making a new child	4	8
Screwing a nose on the devil, putting in the hair of his head and placing a new joint in his tail.................	5	6

The total bill amounted to eleven shillings and fourpence, and it is to be presumed that the workman got his pay, though the records are silent on the point. — *New York Sun.*

Testing pile-Protecting Compounds. — In 1882 several piles, coated with various patent anti-teredo coverings, were driven in the harbor of San Francisco for the purpose of testing them. Last week Engineer Manson began pulling up the piles in order to see the result of the experiments. A pile coated with Pearce's compound, composed of paraffine, limestone, kaolin, etc., was found to be completely honeycombed by the teredos. The eucalyptus and cedar piles were also nearly destroyed. In 1884 the two piles encased by A. W. von Schmidt in sewer-pipe and cement, the twenty-three coated by Frank Shay with asphalt and wire-cloth, the ten of McKeon & Co., coated with warm cement containing a poisonous substance, and those of W. H. Hayes coated with Portland cement, etc., were examined by Colonel Mendel and Mr. Manson. All showed signs of having proved failures. The insect is ahead of the inventors up to date. — *Exchange.*

The Bastile Rebuilt. — The "old Bastile" is in course of construction on the Champ de Mars, and, owing to the progress which has been made with the works, much of the illusion which is intended to be effected may be realized at the present moment. The constructions are at the corner of the Avenue de Suffren and that of La Motte Piquet. The grim fortress appears with its crenelated towers above and ditches below. By its side is the Porte Saint Antoine, and not far away the Church of Saint Mary, a masterpiece of the architecture of the seventeenth century. At hand, also, is the Hôtel de Mayanne, and all these old-fashioned and picturesque places do certainly recall what they are intended to represent, although much of their retrospective interest is somewhat marred by the very modern surroundings of the adjacent Trocadéro, the high nineteenth-century houses, the mass of iron which will soon be Eiffel's Tower, the Military School, and the steamboats which run snorting and puffing over the surface of the Seine. — *London Daily Telegraph.*

The New Capitals at the National Academy of Design, New York. — At the National Academy of Design the carving of the capitals of the corridor pillars has just been completed after waiting nearly a quarter of a century. The work has been done through the contributions of a few patrons of art, Messrs. John Taylor Johnston, Henry G. Marquand, Cornelius Vanderbilt, William E. Dodge, S. P. Avery, Daniel Huntington and J. Q. A. Ward. The seven marble capitals have been carved in conventionalized designs of flowers, fruit, and vines by a local firm of architectural sculptors, each of the donors named selecting one capital as his special gift, and in some instances designating it by some appropriate emblem. Thus a mallet appears among the leaves of the carving presented by the sculptor, Mr. Ward, while the head of a winged bull, symbol of St. Luke, painter as well as physician, looks from the marble flowers given by Mr. Daniel Huntington. Underneath a garland of pears and leaves encircling Mr. Avery's capital is a group of engraver's tools, significant of his former profession. The thistles of Scotland and a wreath of roses form the design of Mr. Johnston's capital. Mr. Vanderbilt's capital has been carved in grapes and grape-leaves, Mr. Marquand's in callas, with the prow of a boat beneath, and Mr. Dodge's in lilies with a fish below. The corbels, carved in lower relief on the inner and outer sides of the arches, present among other ornamentation, the initials of the respective donors, whose graceful act has furnished a much needed enlivenment of the bleakness of the corridor. — *Home Journal.*

TRADE SURVEYS

There are two features among the many upon the surface of trade which are deserving of special consideration with those who are endeavoring to formulate opinions as to next year's probabilities. One is the extraordinary growth of Building and Loan Associations, and the other is the multiplication of projects for building and manufacturing purposes. If there were any apprehensions of a permanent reaction in industrial activity, they are rapidly disappearing. The stock markets exhibit an upward expanding tendency in values. The bulls are having a holiday, and a spirit verging onto stock speculation is beginning to manifest itself in not only Eastern, but in some smaller Western commercial and financial centres. It is roughly estimated that $750,000,000 are finding employment through the channel of Building and Loan Associations, but whether this figure is near or far off the mark, the facts which are known justify the statement that this system of co-operative banking and loaning and buying is expanding with great rapidity, especially throughout States west of the Allegheny Mountains. It was thoroughly tested in Eastern cities, particularly in Philadelphia, and the importance of it will soon become recognized throughout Western cities and towns. Associations have been formed very rapidly this year, and in nearly every Western town steps have been taken to organize the producers into house-building societies. These associations are valuable in their educational features, for they lead to the discussion of questions, to habits of thrift and economy which would never be otherwise developed. It is shown by creditable statistics that for the past ten days over one hundred million dollars' worth of projects have been heard of, and the statement is made upon the same authority, that the spirit of investment is likely to manifest itself more strongly later in the season. The money-market is easy and rates of interest are low. Financial and commercial operations in Western cities, such as Chicago, St. Louis, St. Paul, Kansas City and some others, all show an enormous distribution is going on, and that enterprise is still seizing opportunities of every variety. There is nothing as yet in the horizon to justify much of the apprehension that is expressed in some trade journals. In Philadelphia, during the past ten months, 6,079 two and three story houses have been erected, and in all 6,640 buildings, including warehouses, factories, churches, schools, etc.; the total estimated value of which is, in round numbers, $24,000,000. The builders and architects of that city, in interviews this week, state that the indications for the coming season are fully as encouraging as a year ago. A great deal of land both in and near the city, has been purchased for next year's building requirements. Reliable building authorities in New York say that large purchases of land have been made in suburban localities for building purposes in the upper end of the Island as well as on Long Island. Real estate in the more desirable localities has been steadily advancing in value, although not to the point of prohibiting enterprise. Statements from Chicago within a few days show that there is much to hope for in not only that city but throughout the Northwest next year. While it may be true that railway building has gone a little way ahead of present requirements, no well-informed architect, or builder either, says there are good grounds for believing that building of houses and of manufactories will decline. A great deal of local capital is seeking investment, and outside capital is attracted thither by the good rates of interest offered and the satisfactory results of the investments of the past two or three years. There is another feature worth mentioning at this time, namely, that a great deal of railroad building is projected. The rail-makers held a meeting in Philadelphia this week to decide whether to restrict production or to reduce prices to a non-competing point. There are inquiries for over 100,000 tons in the market. If prices can be fixed it is probable that within thirty days contracts for no less than 500,000 tons of steel rails will be placed. Buyers are expecting to purchase at $30; this is $10 below the price of early summer, and $4 above the lowest point reached nearly two years ago. The anthracite coal miners and consumers are greatly exercised over the probabilities, on the one hand, of a continuance of the strike, and on the other hand of an advancing tendency in prices. A general advance of twenty-five cents per ton will be made on Monday. This advance will affect prices throughout New England States as well as throughout the West. Large shipments are being hastened to Western markets in view of the nearness of the close of navigation. There is a general scarcity of anthracite, but the production, which averages about one hundred and fifteen to one hundred and twenty thousand tons per day will be sufficient to meet the actual demands. The strike will probably continue for two or three months yet unless the companies give way. They announce their purpose of holding out and certainly will not surrender under any circumstances that can now be foreseen. The Connellsville and mountain coke production is about 15,000 tons per day, but with the completion of furnaces now under construction and projected, the production will be not less than 20,000 tons. Extraordinary preparations are being made for an increase of the coke production in the Southern States, and much local and outside capital is finding attractive inducements in this rising industry. There are indications that the employers throughout the country are gaining points as against labor organizations. The boot and shoe manufacturers are about forming a national organization. The building-trades throughout the country are pretty compactly organized, and have held their own in recent conflicts. It is earnestly desired by builders in all sections of the country to adjust all differences during the winter in order that calculations and contracts can be safely entered upon for material for work during the next year. The workmen themselves are coming to recognize that a conservative course on their part is more desirable than an extreme one, and it is quite probable that measures will be mutually agreed upon which will obviate a suspension of work after the opening of the busy season. While it is largely a matter of opinion as to the extent of building enterprise next year, the very best authorities among architects and builders lean strongly to the belief that there will be very little, if any, decline in building activity. Throughout the West the municipal authorities are arousing to the importance of extending school facilities, and a great deal of work of this character will be entered upon. In the great multitude of Western and, in fact, Southern towns, it is evident that there will be a vast amount of shop, factory and house work undertaken. There is an abundance of capital available, and at low rates of interest. Local authorities have been investigating the conditions surrounding the outflow of Eastern financial centres to Western farms, and the investigations show a very encouraging condition of things. Capital which, in years past, was clogged up in Eastern vaults is finding a welcome in the West, where enterprises of almost endless variety are assisted and stimulated in the furtherance of the diversification of industries upon which permanent prosperity depends. The encouraging features of trade and industry above enumerated, as well as in the railway enterprises, are largely due to the great ease in the money-market, but there are a number of minor and less-observed influences which have lead to this result. Manufacturers, jobbers, bankers, investors, and others want to say the prices are going to be somewhat easier. The possibility of an upward tendency in prices is generally given up. On the other hand, the demand for shop-room, house-room, and room of all kinds, as well as for more rolling-stock, more steam-power, and more electrical power of every variety, is strengthening the productive agencies and leading all manufacturers to feel that there is a busy time ahead of them for months to come.

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CONTENTS

A PRELIMINARY circular has been issued for the next convention of master-builders, which is to be held in Cincinnati on the first Tuesday of February next. The circular is purposely issued at a very early day in order that the important subjects which are to be acted upon at the meeting may be maturely considered in the local societies before the delegates from these societies meet for final decision. The first, and, as the circular says, "perhaps the most important" matter to be discussed is that of forms of contract, which the Association wishes to have made uniform all over the United States. To this end a committee was appointed last year to confer with committees from the American Institute of Architects and the Western Association of Architects, and "results of great interest to builders" are said by the circular to have been arrived at. Whether the "results" will prove as satisfactory to architects and owners as to builders, although a question of very considerable importance, is as yet undecided. If, as we understand is the case, the Association proposes to force the form of contract which it adopts upon architects and owners by prohibiting its members from signing an agreement in any other form, it is certainly none too soon to begin the study of the matter if the most serious misunderstanding, if not a total deadlock between owners and contractors, is to be avoided next year. It would be a pity to have the building business of 1888, which, if we can interpret signs, promises, in a great degree through the good judgment and moderation with which the Association has treated labor disputes, to be the largest ever known in this country, choked at the outset by a quarrel about nothing between proprietors who wish to build and mechanics who wish to do the work for them. Practically, it would be a quarrel about nothing, since decent owners wish only to have their work done according to certain specifications for a fixed price and within a given time, and decent builders are perfectly willing to do exactly this, and we have never seen a building contract that contained anything beyond this, except safeguards against dishonesty, bankruptcy or shiftlessness, which are rare contingencies. A certain amount of latitude is, however, essential in providing safeguards of this kind, which must vary with circumstances, and, as no prudent architect would allow his client to sign a contract which did not secure him against all possibilities of loss which he could foresee, a stereotyped form, unless prepared with almost superhuman skill, would in many cases be insufficient or unsatisfactory, and the architect would be bound to advise his client to refuse to become a party to it. Then, if the Master-Builders' Association chose to insist upon its form, a direct issue would be raised. The Association would, we suppose, say that its members were incapable of acting otherwise than according to the most honest meaning of an obscure or incomplete expression, and this would probably be true. The architect, on the other hand, would say that his client must have the same protection against the possible aberrations of an honest man as against the tricks of a known swindler, and a dispute over the provision to be made against a contingency which, as all parties would acknowledge, might not be realized once in a thousand years, might easily become so serious as to array the whole body of architects and builders against each other. As every one knows, the longest and most bitter quarrels are generally those which have no tangible pretext, and architects, as the trustees of the interests of their clients, must, as a matter of principle, refuse consent to any concession which might, in their opinion, in the least endanger those interests. It is possible that the Committee of the Master-Builders' Association, with its advisers, may be able to compose a form of contract which will guard the interests of all parties under any circumstances, but we do not believe that it can be done except as the result of years of experiment and improvement, and we trust that the Convention will be wise enough to promulgate its model form, however perfect it may consider it, at first merely as a commendable suggestion, leaving architects at liberty to modify or vary it as they may deem necessary. There is no fear that architects cannot be trusted to act with fairness toward the builders. In the movement of a year ago, looking to the incorporation of a clause in all contracts, under which delay caused by general strikes should not involve the penalty affixed to delay from other causes, the architects cordially concurred, reserving nothing, so far as we know, except such provision as they thought necessary against the escape of a builder from his obligations through strikes purposely concocted by himself, and there are few of them who do not try to write their contracts in such a way that the duties of the builder shall be as clearly understood as possible, and that the price for which he undertakes those duties shall be paid him in a definite way. More than this it is not their place to do for the builder, but that this is a good deal, those who have worked under building contracts drawn up by lawyers or amateurs can testify, and a misunderstanding between them and the builders on the subject would be a great misfortune for both.

A RATHER curious scheme has been put forward by the New York Board of Fire-Underwriters. For several years the associated insurance companies of New York maintained a board for fixing rates of premium on risks in the city, which, being managed by a gentleman of exceptional ability and good sense, who used his discretion in proportioning the rates to the risk, as determined by the construction of the buildings in which the insured goods were stored, soon gained a great and salutary influence over the methods of building employed in the city, and, if it had been allowed to carry on its work for a few years longer, would have made the mercantile part of New York perhaps as secure against heavy loss by fire as the corresponding portion of any large city in the world. Unfortunately, as a result of quarrels between the companies composing the association, the Board was not long ago abandoned, and building matters, so far as the insurance companies were concerned, began to relapse into the old condition. By this time, however, intelligent merchants had learned something of the simple methods by which fire hazards might be greatly reduced, and new insurance companies, after the relapse into chaos of the system of the old ones, were formed to meet the demand which the better system had created, by providing insurance at low rates for those owners who are willing to submit to regular inspection of their buildings, and to carry out the changes necessary for the simpler sort of protection from fire. It is tolerably well known now in the business community that the mill mutual companies have been able to reduce the cost of insurance in this way to a small fraction of the former rates, and the application of a somewhat similar system to mercantile buildings seemed so feasible and attractive that the new companies soon secured a great deal of business, and the old ones began to find it necessary to do something to enable them to compete with the new comers. For this purpose a new combination was formed, and a committee appointed from the companies, with authority to take what are called "Protected Risks," and to issue policies upon them, under which a low rate of premium is established, on condition that the applicant for insurance makes such improvements or changes in his building or method of storage as may be advised by an inspector, employed by the committee for the purpose. The committee, also, as representing all the companies, is empowered to divide the risks offered it among the companies at its discretion, so that the merchants desiring insurance need make application to one authority only, instead of going either to a

broker or to half-a-dozen different agents, while the insurance companies save the brokerage and agents' commissions, which consume a large share of the premiums paid in ordinary cases.

WE wish we could say that we thought this scheme promised great success. The idea of giving people who try faithfully to prevent their stores from taking fire some preference in point of insurance rates over those who care nothing about the matter is excellent, but it is not new. On the contrary, those who spend money in fire-resisting construction, automatic-sprinklers, and electric alarms, and in extra care in supervision of their business, have thought for a good while that their efforts ought to be recognized by the underwriters in a way more nearly proportioned to the saving in risk effected by such means; and these persons will not be satisfied with the mild flattery of having their buildings classified as "protected risks," or with the mere deduction from their premium rate of half or two-thirds the agents' commission, leaving the net profit to the companies the same as in the case of an unprotected risk. Persons who carry large amounnts of insurance can easily find brokers to procure policies and divide with them the commissions; and unless the reduction in rates on protected risks is made a very substantial one, it will not be worth while to incur any expense to secure it. That the underwriters will make the smallest reduction that will serve is indicated by their past history, and their plan appears to be to get as much of this as they can out of the income of the agents and brokers, who will, of course, oppose any such scheme, while they are powerful enough to make its defeat, if they should combine to attack it, very probable.

THE gentlemen whom the Japanese Commissioners selected as the best architects in Europe, Messrs. Ende and Böckmann of Berlin, write to the *Deutsche Bauzeitung* some observations on the subject of building in winter which are just now very timely. The experience of the firm dates back to 1864, when they were commissioned to build a storeroom in the rear of a bakeshop on the principal street in Berlin. There were special reasons for hurrying the work, and the proprietor urged the architects to allow it to be carried on through the winter. They told him of the opinion, which was then universal, that masonwork done in winter would be so injured by the frost that it would have to be taken down in the spring, to prevent it from falling of itself. He persisted, however, and the work was carried out. When warm weather came, the architects examined the building with some solicitude, expecting to find at least some portions of the wall so disintegrated by freezing as to require replacing with fresh work; but inspection failed to show the smallest spot in which the mortar had not its normal consistency, and, in fact, the work seemed to be even stronger than usual. Since that time, they write, they have never hesitated to build with stone or brick through the severest winters, using hot water and freshly-slaked lime in the mortar in very cold weather, and only interrupting the work when even these precautions fail to prevent the mortar from freezing in the tubs; and they have as yet never seen any bad effect from the practice, beyond the necessity for replacing now and then a little badly frozen work. This, according to them, is very easily done. There is, fortunately, never any doubt as to whether masonry has been injured by frost or not. If the mortar really freezes, it becomes entirely disintegrated, at the same time lifting the stones or bricks out of place, so that, as Messrs. Ende and Böckmann say, after thawing there is nothing left but loose sand between the displaced stones, and, in order to go on with the wall, it is necessary to remove the loose blocks, and brush away the crumbled mortar, down to solid work. This done, building can be resumed on the firm substructure without danger, and the mortar which has not been entirely destroyed by the frost is likely to be harder than if laid in summer. They acknowledge that mortar made with Berlin lime may behave differently from that used in other places; but that their experience in their own city agrees with that of others they infer from the fact that building is now carried on in Berlin quite as assiduously in winter as in summer; and if winter-built walls were as defective as they were once supposed to be, the opening of every spring would be followed by a series of catastrophes.

WE do not know what sort of lime is used in Berlin, but suppose, from the fact that Messrs. Ende and Böckmann use it freshly slaked in cold weather, that it must be tolerably pure, since an hydraulic lime, like the lias lime commonly used in England, or the New York ground lime, would not develop heat enough in slaking to keep the mortar warm. Whether a wall laid in mortar made with such lime is injured by freezing is here, as in Germany, still a disputed question. That the upper courses of stone are lifted and displaced by a heavy frost, and the mortar under and between them disintegrated, is certain, and most architects have had occasion to order a foot or so of the top of a winter-built wall to be taken off before resuming work upon it in the spring; but our experience, which, we suppose, agrees with that of others, is that the joints in the remainder of the wall, if made with lime mortar, or even with mortar containing a small dose of cement, prove in the spring to be in good condition, with the exception of an inch or two on the outside, which shows a loose, sandy mass under a tolerably consistent crust, and ought to be raked out to the hard interior portion, and the wall repointed. It might seem as if the good condition of the lower portions of the wall would be due to its having been defended from freezing by the more exposed portions; but stone is so good a conductor of heat that the temperature of the exterior and interior of an exposed wall could hardly vary greatly, and we have seen masonry laid with stones so cold that the mortar froze to them, which appeared in good condition in the spring, with the exception of a superficial disintegration of the mortar. Not knowing how else to account for the phenomenon, we have thought it possible that mortar under a superincumbent weight sufficient to prevent it from expanding might not lose its consistency by freezing, and, that this would explain the fact that the crumbling was confined to the upper portions, and the outside of the joints, where the resistance to expansion is slight. It is true that if lime mortar expanded in freezing with the force that clay or wet gravel does, the weight of one or two feet of stone would not keep it in place, but there is some reason for supposing that its expansion is comparatively feeble. Although the climate of Berlin, in regard to winter temperature, is much like ours, it is protected by its latitude, nearly eight hundred miles north of New York, from one of the greatest risks to which our winter-built structures are exposed,—that of alternate freezing and thawing on the same day. With us, even in January, the sun is often so warm in the middle of the day as to melt the south side of a wall laid up the day before with cold bricks, and frozen in a few minutes afterward; and the wall consequently bends toward the sun. As the mortar is only softened on one side, it is difficult to bring the wall back to the vertical, and it is often necessary to take it all down, and start afresh, in order to continue work on the building. Of course, these observations do not apply to masonry laid in cement, which is far more seriously affected by freezing than lime; and with cement walls built in winter it is a wise precaution to heat the bricks over a furnace like those used by coal-tar concreters before using them. Warmed in this way they will retain the heat long enough to enable the cement to set before the frost can affect it. The whole subject of the behavior of mortars and cements in cold weather is as yet little understood. Ten years or so ago, so excellent an authority as Trautwine asserted that cement mortar was not injured by freezing, but this assertion has been disproved by ample evidence, and is omitted in the later editions of his hand-book. The new practice, of adding salt to mortar to prevent it from injury by frost, bids fair to become of great importance, but further experiments are much needed.

A NEW sort of ornamental glass is now made in Paris by M. Bay, which he calls by the name of hoar-frost glass,—"*verre givré*," from the pattern upon it, which resembles the feathery forms traced by frost on the inside of windows in cold weather. The process of making the glass is simple. The surface is first ground either by the sand-blast or the ordinary method, and is then covered with a sort of varnish. On being dried either in the sun or by artificial heat, the varnish contracts strongly, taking with it the particles of glass to which it adheres; and, as the contraction takes place along definite lines, the pattern produced by the removal of the particles of glass resembles very closely the branching crystals of frost work. The pattern may be varied in character by changing the thickness of the film of varnish. A single coat gives a small, delicate effect, while a thick film, formed by putting on two, three or more coats, contracts so strongly as to produce a large and bold design. By using colored glass, a pattern in half-tint may be made on the colored ground, and, after decorating white glass, the back may be silvered or gilded.

WESTERN ASSOCIATION OF ARCHITECTS.



From Bruges Belgium

THE Western Association of Architects held its fourth annual session in the ladies' ordinary at the Grand Hotel, Cincinnati, O., last week.

WEDNESDAY, NOVEMBER 16.

The first session was called to order at about eleven o'clock Wednesday morning by Mr. John W. Root, president. After the roll of members was called by Mr. Samuel A. Treat, treasurer, Mr. Root made the following

PRESIDENT'S ADDRESS.

Gentlemen, — As members of the Western Association of Architects, we meet under most auspicious circumstances.

The Association which was founded so short a time since, whose possibilities not only for good to its members, but for existence in itself, were then considered doubtful, has vindicated its right to be, and has proved itself strong in many potencies of future usefulness.

At this meeting, as at all annual meetings, let us recall certain facts inherent in such an association of men; and let us, moreover, glance for a moment at tendencies which will be recognized as common to almost each individual member, and ask if these tendencies be altogether for good.

When a large group of men band themselves into a corporate organization, the community of interest thus implied must be based upon a few essential facts, or the association is one in name only. True democracy is among these facts most prominent. Each one must have most nearly at heart the interest of all, and each one must be prepared at every time, and for the ultimate good of all, to surrender small and temporary personal advantage for the common good.

We are all, in this union, upon a level plane. The heads of some may tower above, but the feet of none may stand below those of their brethren. Each man, therefore, recognizes the fact that so far as can ever be possible, every advantage is conceded to his fellows that he could ask for himself, and that in no act of his shall his brothers' rights be abridged by a hair's breadth. This being true as a matter of theory, how shall it become fully realized as a matter of practice.

First, let us answer, by cultivating among ourselves relations of perfect understanding and friendship. Men are so largely influenced by personal ends, that no relation can ever be established so ideal in its common help and consideration as that existing between two friends; and I am persuaded that out of any ten of the grievances one of us may, in professional practice, have suffered from another, nine will be found directly traceable to misapprehension and consequent estrangement. The short way to avoid these grievances is to cultivate such warmth of personal relationship that no man of us need for a moment hesitate, in any case of doubt or possible mistrust, to ask of his friend full and free explanation. Once this state of affairs is brought about, our Code of Ethics writes and enforces itself; and until it is brought about, any code of ethics must be inadequate. At the same time I am persuaded that we need some well-considered and strongly formulated code of ethics. It is true that among us is a fairly good understanding of those matters in which we may encroach on the rights of others; but we need common reference, — a plain statement of these matters, so that each man may be strengthened in right doing, and feel the weight of general displeasure when he goes wrong. This is a matter of universal recognition, that men are apt to act with least circumspection in those affairs which lie so closely along the debatable line of right and wrong, as to escape the precise definition of the law. And of these, we, in common with all men and all associations, must continue to have enough, but in architectural practice, and in the complex relationships pertaining thereto, there are many general understood matters apart from the regulation of fees and competitions which would gain immense access of moral force by incorporation into a carefully drawn and rigidly enforced code.

In theory, a profession is in no one way elevated above a trade, than that among its members certain methods are eschewed, which, among tradesmen may be legitimate.

Let us, code or not, keep this fact in mind, and in these respects act up to our profession. Among our professional brethren, he is wisest who keeps himself most actively in the wholesome atmosphere of general circulation. No one of us has cause for fear in the success of another, unless he himself is unworthy; for the success of one is the gain of all, and the goal attained by your rival of to-day, is only a mark to be passed by you to-morrow. Honestly passed; not by small and dishonorable means; not by unconscious assimilation or the *finesse* of doubtful politics, but by hard work and elevated ideals, by placing ourselves in sympathetic connection with those great forces of nature, and those masterpieces and minds in Art which are our common heritage of strength and inspiration.

One word as to tendencies which seem to be manifested in much of our present work. It is now fashionable to smile in a superior way at the architects of thirty years ago, who prided themselves upon the scholarly correctness of their styles; how much more justly might those architects smile at the barbaric incorrectness of ours. Not that "correctness of style," as formerly understood, means much; but each one of the "styles" set down in the books, means the average thought of most profound and thoughtful men, whose work we may utterly set aside when we are as thoughtful and profound. The thing to insist upon is thought, — not dexterity of pencil or newness of "fad," but the full expression of one dominant and well thought-out idea.

Idea is the crying need of our modern architecture. In England, if we may judge by the illustrated periodicals, architects are pitiably fortunate in having so far passed us as not only to be sadly lacking in ideas, but to be utterly unconscious of their imbecilities. For us there is no need for the state of mind in which men, in the high name of Art, live to momentarily galvanize into a semblance of life forms which breath only for the passionate and patient worshipper. Architecture is not a system of incoherently uttered and illogically occurring fashions. Architecture is not a "fad" which is respectable to-day because it apes the work of some great man, to whose creations it is comparable only as a jackdaw is to an orator. It is not architecture in whose name we dare erect to-day rough and brutal piles of stones, whose only merit is the roughness, and which to-morrow we will spurn from us as unkempt tramps of things. Architecture is the material expression in stone, and iron, and brick of an idea, dominating, consistent, coherent, source and inspiration of ten or a thousand thoughts, but giving character to all. As such it can afford to lose sight at no instant of one thought by its great apostles and prophets.

These traditions which have lived for centuries are not to be venerated for age alone, but for their truth; they are not sacred because of their age, but are old because of their truth. All architecture based upon mere caprice is less enduring in the history of art than a breath.

Be it ours, therefore, to infuse into all of our work, that earnest thought which will make it lasting.

The reading of the minutes of the last meeting was dispensed with, and Mr. Dankmar Adler, as chairman, read the following

REPORT OF THE BOARD OF DIRECTORS.

The following business has been transacted by the Board since the last Convention: —

The charges of unprofessional conduct by Mr. E. W. Hammatt against Mr. J. C. Cochrane, were investigated and dropped without action, after the Board, as well as Mr. Hammatt, had become convinced that they could not be substantiated by legal proof. In this connection the Board deems it proper to advise members of this Association that charges similar to those of Mr. Hammatt's can never be substantiated except with the assistance of one or more of the participants in the alleged corrupt or unprofessional action, just as accusations of bribery can rarely be proved except by the confession of either the briber or the person bribed.

The financial condition of this Association may be summarized as follows: —

At the time of the last Convention, there was on hand in the Treasury, the sum of $854. There has been received since that date the sum of $1,182 from dues of members. The expenses aggregate $1,260, leaving in the Treasury the sum of $775.33. $300 of uncollected dues, ———, which, together with ———, make the total assets of this Association, $1,075.

The purposes for which the before-mentioned expenditures were made, were as follows: —

For postage, stationery, and other office expenditures	$393.66
For travelling expenses of Committee appointed to represent this Association at the Convention of A. I. A., in 1886	143.88
For travelling expenses of Directors to and from meetings of the Board of Directors	135.55
For travelling expenses of Secretary	71.10
For salary of Secretary	200.00
For type-writing machine	90.00
For initiation fee returned	20.00

The Board recommends that the travelling expenses of delegates appointed to represent this body at conventions of kindred architectural associations be not hereafter allowed.

The desire for the establishment of a uniform form of building contracts to which utterance was given at the last Convention of this Association, has found expression in the National Association of Builders, which Association has adopted resolutions to the effect that the working-out of this problem be assigned to a joint committee, consisting of three representatives of the National Association of Builders, three of the American Institute of Architects and three of the Western Association of Architects. Your Board of Directors has taken upon itself to promise on behalf of this Convention that such Committee will be appointed, and hereby recommends that this be done.

At the Convention of the A. I. A., held at Chicago last month, a committee was appointed, with instructions to meet a corresponding committee, to be appointed by the W. A. A. for the purpose of determining, if possible, a practicable plan for consolidating into one body all the architectural associations of the United States. It is the opinion of your Board of Directors that such consolidation would be of the utmost value to our profession, and it recommends the appointment of such committee.

In view of the large number of applicants for membership of this Association, your Board of Directors recommends that the greatest possible care and circumspection be exercised in balloting, so that none whose membership would reflect discredit upon our Association be admitted. The Board of Directors believes that you will find the present system of admitting members but little more satisfactory than that in vogue before this year, and in this connection wishes to call your particular attention to the report of the Committee on Raising the Standard of Membership of this Association, and recommends and urges most strongly the immediate carrying into effect of the recommendations of that Committee.

The Board of Directors further recommends the adoption of amendments to Constitution and By-Laws: First, that one Vice President to be elected by this Association be for the appointment to the Vice-Presidency of all Presidents of State Associations, and corresponding alterations of Sects. V and VI of the Constitution

It is also recommended that Art. III of the By-Laws be made Sect. VII. of the Constitution; that the President be made, *ex-officio*, a member of the Board of Directors; and, finally, it is recommended that in view of the haste with which the Constitution and By-Laws of the Association were drafted, they be referred to the incoming Board of Directors for such modification as will harmonize these different Sections with each other, and with the actions of this Association at its various Conventions.

Finally, the Directors wish to express their sorrow and regret that the hand of death has removed from our midst, Mr. Thomas U. Walter, the architect of the United States Capitol, the venerable ex-President of the American Institute of Architects, before the recommendation of this Board that he be made an Honorary Member of this Association could be carried out, and suggests that a committee be appointed to draft resolutions of respect to his memory.

The report was accepted.

Mr. J. F. Alexander, secretary, then read the report of the Committee on

THE ORGANIZATION OF STATE ASSOCIATIONS.

It showed that such associations had been formed at Nashville, Tenn., Milwaukee, Wis., Birmingham, Ala., Louisville, Ky., Detroit, Michigan, Rochester, N. Y., and New Orleans, La. Regular meetings had been held in all States but Indiana, and the committee recommended that the association in that State be abandoned in order to make a reorganization possible.

The report was accepted and placed on file.

Mr. D. Adler, of Chicago, read the following report of the Committee on

STATUTORY REVISION:

Your Committee has reported to you at the Convention of 1885, the drafts of two proposed enactments, one for the regulation of the practice of architecture, by the legislatures of the different States, and another proposing a radical reform in the regulation of the buildings of our National Government.

Neither of these bills have as yet become laws, and your Committee, therefore, does not deem it advisable to propose further statutory enactments, but recommends that the different State associations be requested to renew their efforts with the legislatures of the respective States for securing the adoption of an enactment similar to that presented to the St. Louis Convention. In this connection, each State association is recommended to employ, during the session of its State legislatures, a special agent whose duty it shall be to secure all information obtainable as to the views upon the proposed bill of individual legislators and members of committees, and to communicate these to the Committee of the State Association in charge of the bill; also to make appointments for hearings of this Committee before the legislative committees.

Your Committee also recommends that a sub-committee be again appointed to take the Bill for the Regulation of the Erection of National Government buildings, and by consultation with the Committees on Public Buildings and Grounds of the two houses of Congress, make such modifications of the bill presented at the Convention of 1886 as will tend to secure its passage.

With reference to the last-mentioned bill, your Committee recommends further the engagement of a paid agent with duties similar to those indicated in connection with the work to be done with State legislatures.

Your Committee finally recommends that each individual member of the Association make it his mission to do all in his power to influence public opinion in the favor of the proposed measures, by conversation and argument with friends and acquaintances, and through the press. Legislative action will always follow a well-defined and distinctly-expressed public sentiment, but this can only be developed by the united efforts of those who first require the necessity for the proposed legislation.

The report was accepted.

Mr. Adler then read the report of the Committee on the

BILL GOVERNING THE OFFICE OF THE SUPERVISING ARCHITECT

as follows:

Your Committee reports that immediately after the Convention of 1885 it placed itself in communication with the corresponding committee of the American Institute of Architects; that in conjunction with said Committee it made several modifications of the proposed bill, and that a delegation of the two committees visited Washington after the introduction of the bill in the House of Representatives, by Mr. Hewitt, at the instance of Mr. A. J. Bloor, of the Committee of the American Institute of Architects; and that your joint Committee had sundry interviews with members of the Congressional Committee to which the bill has been referred, but were not successful in securing its passage at that session of Congress.

It is the opinion of your Committee that the legislation we desire upon this subject can never be had unless there were unmistakable expressions of public opinion in its favor. It is the duty of the architects of this country who, more than any others, are capable of recognizing the abuses of the present system, and devising measures for their correction, to do all in their power to demonstrate to the public through the press and by all other means at their disposal, the correctness and soundness of the measures taken by this Association. For this purpose every member of the Western Association of Architects should constitute himself a committee of one charged with the duty of exerting to the utmost his persuasive abilities upon all with whom he may come in contact, and thus building up, by the time fixed for the meeting of the next Congress, a public sentiment so strong that it cannot be resisted by the representatives of the people in Congress.

The American Institute of Architects has continued the duties and functions of the Committee with which we have been associated, and has added to its *personnel* Mr. M. E. Bell, formerly Supervising Architect of the Treasury Department, and a Western member not yet appointed. We recommend that similar action be had by this Convention, *i. e.*, that the duties and functions of the present Committee be continued, and that the *personnel* of the same be fixed as the Convention may see fit.

The report was accepted by the Association.

Mr. Louis H. Sullivan, of Chicago, then read the report of the Committee on a

STANDARD OF PROFESSIONAL REQUIREMENT.

It was as follows:

Gentlemen, — The difficulties which arise in connection with this subject are manifold and perplexing. If the standard of admission to membership be fixed with sole regard to what is supposedly an ideal, the numerical growth of the Association would be seriously checked, and its usefulness in many ways impaired. For it is evident that such a policy would preclude the admission of those of average capacity, and of the many bright ones who are contending against the difficulties which beset a beginner.

On the other hand, if the standard be fixed so low as to make possible the admission of all, it is evident that the standard of the Association would degenerate, and through the prevalence of a low tone its influence for good would cease, and its career be short-lived.

It is assumed by your Committee that the policy of the Association in this regard should be broad and democratic. That it should not set up factitious barriers against those who ask for admission; that the Association wishes to count among its members every thoughtful, earnest, ambitious man in the profession; that it desires its strength and stability to be derived from the standing and capacity of the average man; that it welcomes the fervor of youth; that it cherishes the honorable record of old age; that, above all, it shall not place its standard for admission higher than it is itself prepared to exemplify.

It is assumed as a paramount consideration that the applicant's record, be it short or long, should prove honorable; second, that he evidence fair artistic, constructive, or executive skill; third, that his admission shall necessitate an expressed pledge upon his part to sustain by individual effort a sound standard of professional bearing.

We believe, moreover, that this Association, prior to raising in any way the standard for admission to membership, should itself declare the standard which it is willing should govern its own course; that in short, we believe the time is now ripe for the promulgation of a code of ethics which shall define a desirable and practicable relationship of the members of this Association to each other, and to the incorporate body: a code which, in a word, shall indicate the degree and nature of the self-respect and good faith of this Association.

Each year we met in conference for three days; but it is during all the days of the year that we each, individually, should labor to raise, a little at a time, the standard of attainment in our profession. During the three days of the convention we compare notes, we reach joint conclusions, we formulate them — we crystallize the experiences of the year past. Therefore the Association would seem to stand, and should stand before the world, as a symbol and index of the architectural profession in the West — a sign by which it may be known and judged.

Although we do not understand this consideration distinctly to lie within the province of your Committee, yet it seems so close upon the border, that we feel justified in earnestly recommending to the Association that a committee be appointed to prepare such a code, and that its report be considered at the Convention of 1888. That such a committee consist of three members from each State who shall constitute sub-committees each with its own chairman; that the sub-committees shall report to the chairman of the general committee on the 1st of April, 1888; that the general chairman shall forthwith collate these reports, and report the results to the sub-committees on the 1st of August; and that the consensus of their revisions, as formulated by the chairman of the general committee, shall constitute the report of the Committee to this Association.

By such means, after a year of careful investigation and deliberate thought, the full sense of this Association may be obtained — and expressed in a code of ethics.

To resume the prime consideration — this committee recommends the following form, for application-blanks, to be addressed through the Secretary to the Board of Directors.

——, 188—.

To the Board of Directors, W. A. A.: —

My full name is ——

My business address is ——

The name of my firm is ——

I have practised the profession of architecture for —— years.

The accompanying photographs (unmounted), numbered, respectively, 1, 2, and 3, show completed buildings erected from my plans and under my supervision.

No. 1 is a [here give general description of building, giving, also, name and address of owner and contractors.]

No. 2, do.

No. 3, do.

The accompanying letters, numbered 1, 2, and 3, are from the respective owners of the above buildings, and endorse my character and proficiency.

We, members of the W. A. A. hereby endorse Mr. —— ——'s application for membership. We know him personally; we believe him to be worthy of membership.

——.

——.

——.

These applications are to be considered confidential by the Board of Directors, who shall meet on the first Monday in August of each year for the purpose of considering applications, after which date no application will be received.

The Board of Directors shall pass upon the application, rejecting

such as seem to them unfit, and as soon thereafter as practicable, but not later than the 1st of September, shall cause to be printed and mailed to each member of the Association a list, containing the names and addresses of the provisionally-accepted applicants, together with the names and addresses of their lay and professional endorsers.

Opposite the names of each applicant shall be printed the words "yes" and "no," and each member shall vote by striking out the word alternative to his decision.

This list shall then be signed by the voter and shall be mailed to the chairman of the Board of Directors through the Secretary of the Association, who, at the ensuing Convention, shall announce the election of all such who shall not have received more than five negatives.

Should vigorous protest be made by any member at the time of voting, it shall be the duty of the Board of Directors to make thorough investigation, and their decision shall be final as to the protest. The Board of Directors shall advise methods for maintaining the privacy of such letter-ballot.

The following blank form is recommended as embodying the above:

Office of Secretary W. A. A., ——— ——, 1887.

Dear Sir, — Please vote by striking out the alternative word under the heading "vote," and return this sheet to me at your earliest convenience.

Vote.	Applicant.		Lay Endorsers.			Endorsing Members.	
	Name.	Address.	Name.	Occu.	Address.	Name.	Address.
No. Yes.							
No. Yes.							

——, *Secretary W.A.A.*

By order Board of Directors.

——, *Chairman.*

The report was accepted.

The Secretary then read several letters from the secretaries of architectural societies abroad, acknowledging the receipt of the annual report and commenting on the good work of the Association, etc.

CONSTITUTION AMENDED.

Mr. Adler urged that two vice-presidents should be provided for in the constitution, so that the Association should not have to depend, in the absence of the president, upon the vice-president of the State Association of the State in which the meeting was held. He later urged that the president should be, *ex officio*, a member of the Board of Directors. The amendments were made as suggested.

Mr. N. S. Patton, of Chicago, desired to have the vice-presidents, *ex officio*, members of the Board of Directors, but his motion was defeated.

On motion of Mr. Adler, the new Board of Directors to be elected at this meeting was requested to revise the Constitution and By-Laws, in order to weed out the crude and inconsistent portions.

Two Nominating Committees were then appointed to name two tickets for officers for 1887–1888, and to suggest places of holding the next meeting, as follows:

First Committee: Walter R. Forbush, A. Y. C. Clas, C. O. Arey, Normand S. Patton, C. C. Hellmers.

Second Committee: Dankmar Adler, W. S. Matthews, C. A. Curtin, Frederick Baumann, H. L. Gay.

On the question of membership, Mr. Adler, Chairman of the Board of Directors, reported that all applications, over one hundred, had been made in regular form, save those asking membership for members of the State Associations of Alabama and Michigan, and after complete investigation the Committee recommended that those informalities be overlooked.

The following resolutions were offered by Mr. Louis H. Sullivan, of Chicago, and adopted:

That the Board of Directors be empowered and instructed to proceed hereafter in matters of election to membership, upon the basis of the report of the Committee on Raising the Standard of Admission of Membership.

That a committee be appointed to prepare and submit at the next annual convention, a Code of Ethics. That the President appoint himself a member of this committee. That such committee shall consist of three members from each State, who shall constitute sub-committees, each with its own chairman; that the sub-committees shall report to the chairman of the general committee, on the 1st of April, 1888; that the general chairman shall forthwith collate these reports, and report the results to the sub-committees on the 1st of August; and that the concensus of their revisions as formulated by the chairman of the general committee, shall constitute the report to this Association.

The Chairman appointed the following gentlemen on this Committee:

L. H. Sullivan, General Chairman; J. W. Root, S. A. Treat, Illinois; J. F. Alexander, J. W. Hammond, J. W. Reed, Indiana; J. G. Cutler, W. W. Carlin, Louise Bethune, New York; W. H. Tyndall, J. E. Flanders, N. J. Clayton, Texas; L. M. Wood, J. G. Haskell, E. T. Carr; Kansas; S. J. Osgood, M. H. Parker, Michigan; H. P. McDonald, C. A. Curtin, H. L. Rowe, Kentucky; A. E. Cobby, Dakota; G. B. Ferry, E. T. Mix, G. Staltz, Wisconsin; Sidney Smith, L. Mendelssohn, G. W. Field, Nebraska; C. C. Burke, J. H. Matthews, Tennessee; A. C. Bruce, J. H. Morgan, A. M. McMurphy, Georgia; C. C. Hellmers, C. E. Illsley, Adrian Van Brunt, Missouri; F. G. Corser, G. M. Goodwin, D. W. Millard, Minnesota; W. L. Black, E. H. Taylor, J. M. Martin, Iowa; J. W. Roberts, N. W. Wall, G. E. King, Colorado; Chas. Crapsey, G. W. Rapp, C. F. Schweinfurth, Ohio; J. S. Matthews, Wyoming; J. B. Randall, New Mexico; T. S. Sully, Louisiana.

Several invitations were read, those of the Merchants' Exchange and of the Art Museum, being notable ones.

The Mayor of Cincinnati, Hon. Armor Smith, was then introduced and made a short speech.

The Association then adjourned for lunch, and at two o'clock took carriages, and, guided by the Local Committee, drove over the city, several fine residences being thrown open for inspection.

The exhibit of drawings was very tastefully exhibited in the large halls and parlors of the Grand Hotel, and consisted of the American Institute exhibit, reinforced by about as many more. It attracted much attention.

At adjournment, the book showed that sixty-five architects had registered their presence in the hall.

THURSDAY'S SESSION.

It was eleven o'clock when the members all got seated and President Root called for the report of the Treasurer. It was read by Mr. Treat, and showed:

RECEIPTS.	
Balance on hand, November, 1886.	$ 854.02
Received.	1237.00
Total.	2091.02
DISBURSEMENTS.	
Expended.	1260.69
On hand now.	830.33

The report was referred to an Auditing Committee, which afterwards reported it to be correct.

Mr. N. S. Patton, of Chicago, read the following as a report of the Committee on

THE METRIC SYSTEM.

The work of your Committee on the introduction of the Metric System, has been mostly of a preliminary character. It is not to be expected that a reform of so sweeping a nature can be brought into immediate use. We do not need brilliant and spasmodic efforts as much as patient and persistent pushing of the subject into the public view until it receives the attention which it deserves. During the past year we have learned in what channels we can best direct our efforts, and have made a beginning in the way of practical work. Our successors will find the path marked out for them, and will be able to enter at once into effective operations.

Your Committee has had considerable correspondence with the Committee on Weights and Measures of the Boston Society of Civil Engineers, which seems to have been aroused to renewed effort by the action taken by this Association at its last Convention. Mr. Fred. Brooks of that Society read a paper in discussion of the Committee's report. This discussion and the report of the Committee, have been printed in a special pamphlet, a copy of which is hereto attached. Mr. Brooks has kindly furnished several thousand copies of this pamphlet to our Committee. We have distributed a portion of them, and it is the intention to send the remainder to other societies in connection with a circular letter explaining the action taken by this Association, and requesting coöperation in bringing the subject to the attention of Congress.

The special work of our Committee is to petition Congress, and persuade others to do the same; but how can we present an effective plea unless we are fully persuaded in our own minds, and how can our plea have any weight unless it represents the intelligent opinion of the whole profession? Therefore, it seemed important to collect information concerning the practical application of the metric system to architectural work. Mr. Adler has assisted our Committee by preparing a circular letter and sending the same to several architects in Germany, making inquiries as to the workings of the metric system in their practice. Replies have not yet been received to these circulars; when such arrive it is proposed to prepare a report on the application of the metric system to architectural practice.

It is obvious that the introduction of any general change in our system of weights and measures must come through congressional action. Such action can only be secured by persuading Congress that there is a general demand for the proposed reform.

Influence must be brought to bear on Congress in the right manner and at the right time, therefore, the most important preliminary step is to determine the time and manner of our application to Congress. In the opinion of the Committee it will be impossible to secure from Congress, at any near date, the passage of a law making the use of the metric system compulsory throughout the country. Another partial measure seems to give greater promise of success.

In 1866 the Congressional Committee on Coinage, Weights and Measures proposed the exclusive use of the metric system in the Government service. This measure has been urged by various societies, and was brought before Congress in the form of a bill in 1884, and again last year.

Congress has not yet appreciated the importance of this subject, and has taken no action. At the coming session let the Western

Association of Architects add its influence to that already in the field, and let us arouse our friends and neighbors to join us. The reform is sure to come sooner or later; let us make it sooner.

The advantage of using the metric system in the Government service is apparent without argument. It will antagonize no private interests and cause no expense to private parties. It will give a practical test of the system on American soil, and that test will be varied and complete. The custom-houses, navy-yards, light-house board, and Government architect's office, will demonstrate whether the system is adapted to the varied wants of professional, mechanical and commercial pursuits. Then, after a fair trial, the favorable reports of the Government officials will ensure the passage of a law making the use of the system compulsory throughout the land.

A communication was addressed to the American Institute of Architects suggesting that the Institute revive the interest which it had formerly manifested in this reform. This communication was acted upon by the Institute at its recent Convention, the subject being referred to the Board of Trustees with power to act.

In conclusion, we urge the appointment of a Committee to continue the work we have begun, and emphasize the importance of active efforts on the part of every friend of the reform. Even benighted Mexico has adopted the metric system, and it is time that the United States put itself abreast of the progress of the age in this important matter. Respectfully submitted,

T. B. Annan,
N. S. Patton,
Chas. Crapsey.

The Association accepted the report, and appointed Messrs. N. S. Patton, J. J. Flanders and F. S. Allen to look after metrical legislation.

The Secretary read a short report of the Committee on

A UNIFORM CONTRACT.

It recommended a uniform contract, but not a uniform specification. It asked for a committee to confer with the committee of the National Association of Builders and the A. I. A. on the same subject, and Messrs. D. H. Burnham, J. F. Alexander and Sidney Smith were so appointed.

On motion of Mr. Adler, a committee was appointed, consisting of himself, G. B. Ferry, W. W. Carlin, A. Van Brunt and John W. Root, to confer with the A. I. A.'s Committee on

ARCHITECTURAL CONSOLIDATION

of all existing societies, to make a report in detail for submission to all the members.

Seventy-eight new members were then elected.

NEW OFFICERS

were elected as follows: *President*, Sidney Smith, Omaha; *Vice-Presidents*, J. F. Alexander, Lafayette, Ind., and W. C. Smith, Nashville, Tenn.; *Treasurer*, Samuel A. Treat, Chicago; *Secretary*, Normand S. Patton, Chicago; *Directors*, John W. Root, J. J. Flanders, Chicago; G. B. Ferry, Milwaukee; C. F. Schweinfurth, Cleveland; W. R. Forbush, Cincinnati.

CLOSING BUSINESS.

Votes of thanks were extended to the State Association of Architects of Ohio and all others who had aided in entertaining the members.

Henry Whitestone of Louisville, John M. Van Osdel of Chicago and A. J. Bloor of New York were made Honorary Members.

The new Directors were asked to draw up suitable resolutions upon the death of Mr. Walter and send them to his family and to the A. I. A.

Mr. C. C. Helmers, of St. Louis, made a verbal report for the Committee on

LEGAL DECISIONS

and spoke of the magnitude of the work. After some discussion, it was decided to continue the committee and allow it to employ legal assistance if desired.

It was voted to hold the next meeting in Chicago, and the Convention adjourned.

THE ILLUSTRATIONS

[*Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.*]

THE PARLIAMENTARY LIBRARY, OTTAWA, CANADA. MESSRS. THOMAS FULLER AND CHILION JONES, ARCHITECTS.

(Gelatine Plate, issued only with the Imperial and Gelatine Editions.)

While the architects, mentioned above, in 1860, designed and built the building, the interior of the building was finished in 1876, after the designs of Thomas S. Scott, R. C. A., at that date chief architect to the Department of Public Works. Some references to this building may be found in the *American Architect* for October 15, last.

THE OLD HOMESTEAD OF THE BALDWIN FAMILY, NORTH WOBURN, MASS.

This fine old house dates from 1651 or '61 — confirmed by the inscription of these figures on one of the old roof-timbers. Though changes have been effected, it stands substantially the same in its own quiet dignity, and not a few persons of distinction, socially and historically, in the Revolutionary period, we can picture as having gathered around its hospitable hearth. Sewall, in his history of Woburn, makes special reference to the social distinction during the Revolutionary War, of Colonel Loammi Baldwin, son of James and Ruth Baldwin, and descendant in the third generation from Deacon Henry Baldwin, one of the first settlers of Woburn and subscribers to the Town Orders drawn up at Charlestown for the regulation of the projected settlement in December, 1641. James Baldwin was a carpenter and master workman in the erection of Burlington Meeting-house, still standing. Loammi Baldwin, school-fellow with Benjamin Thompson — afterwards Count Rumford — at Master Fowle's, and afterwards companion in their walks from Woburn to Harvard, enlisted under Colonel Gerrish, was promoted and, on the retirement of the latter, put at the head of his regiment, and on December 25, 1776, accompanied Washington in the desperate expedition which resulted in the capture of the Hessian troops at Trenton. After his retirement, from ill health, from the army, Colonel Baldwin was associated with various engineering schemes. Always interested in farming and fruit production, to him we are indebted for the cultivation and perfecting of the Baldwin apple. He died in 1807. Of his sons, James Loammi and George Rumford, James settled as a merchant in Boston, and at one time was a member of the Senate for Suffolk. He made the first surveys for a railroad from Boston to Hudson, and had charge of the construction of the Boston and Lowell Railroad, and was one of the commissioners for introducing Cochituate Lake water into Boston. He died in 1862.

Loammi — born 1780, and who died 1838 — graduated at Harvard in 1800, and, after some vicissitudes, we find him established as an engineer in Charlestown. One of his first works was the construction of Fort Strong, Noddle's Island (East Boston), in 1814.

Among his works are the following: the Union Canal, Pennsylvania, seventy-nine miles long; the naval dry-docks at Charlestown, Mass., and Norfolk, Va., both in progress during the years 1827 and 1834 (here may be inserted an interesting fact, showing the lack of engineering machinery at that time in that the pile-drivers at Charlestown dock were worked by a treadmill!) Loammi was associated with the projectors of the Bunker Hill Monument; in 1825 was appointed engineer to report on the project of canal from Boston to the Hudson River, with a view to a connection with the Erie Canal. This report was considered one of the most exhaustive and complete engineering documents of the time; in 1827 was appointed to procure surveys and estimates for a railroad from Boston to the Hudson, which work was put into his brother James's hands, as he, at this time, received appointment for the two big naval docks which formed the principal works of his life.

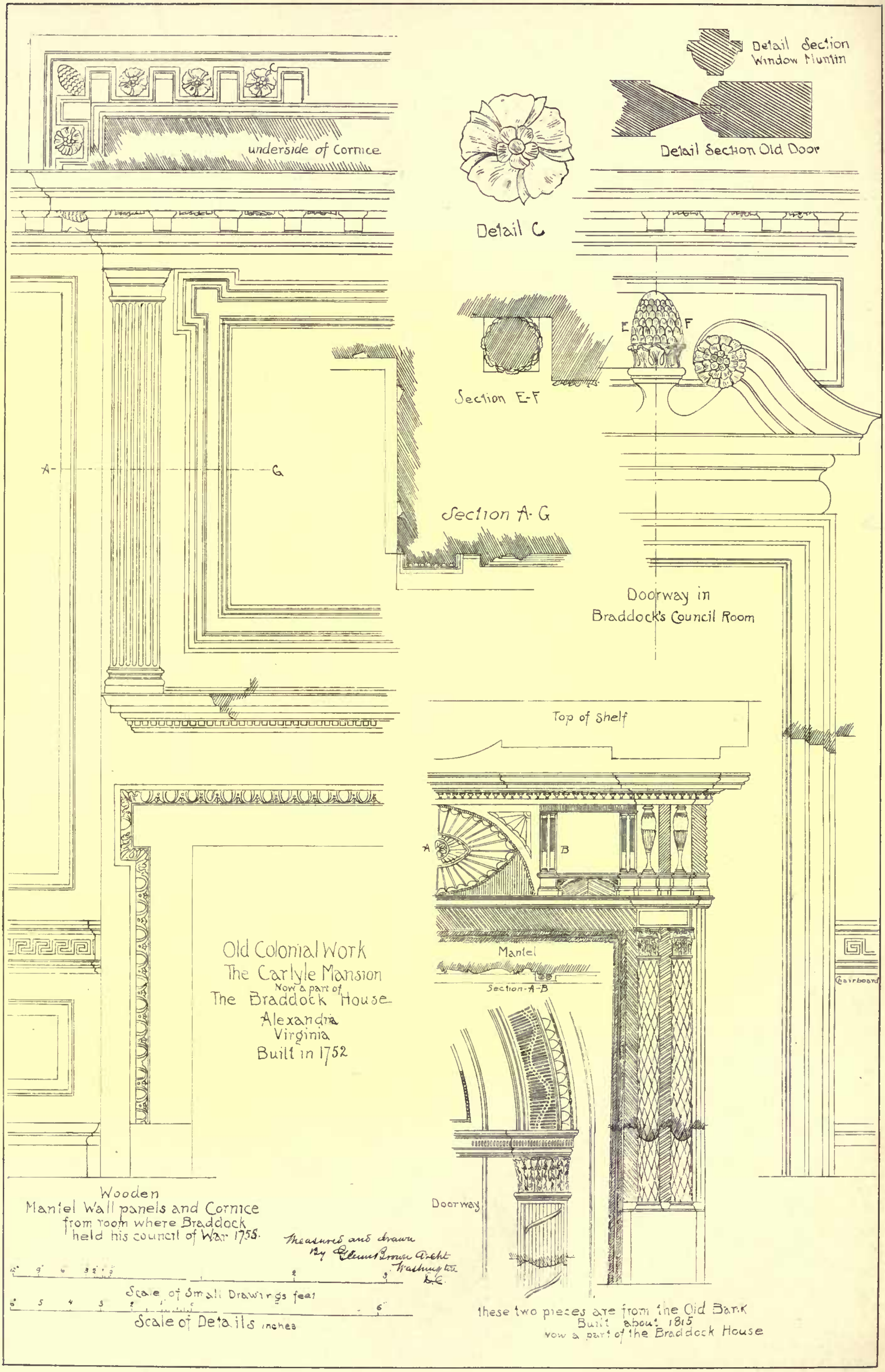
Prof. G. L. Vose — from whose pamphlet on the life and works of Loammi Baldwin, most of these remarks are gathered — says: "No man so well deserves the name of the 'father of civil engineering' in this country, living as he did before the days of the railway system and before engineering was recognized as a profession. His name is known to few of the present time, yet there are very few works of internal improvement in the first thirty years of this century with which he was not connected."

George Rumford Baldwin, still living, and who spends his summers and winters alternately at Woburn and Quebec, became an engineer when quite a young man. He built the graceful ellipitical stone arch over the Middlesex Canal at Medford, still standing. He was a particularly fine draughtsman — designed and built the Boston Marine Railway — was engineer for the Charlestown water-works and also for the water-works of Quebec. He prepared plans for the Schuberacadie Canal, in Nova Scotia; was connected with the early surveys of Cape Cod Canal, and was consulted by the State in regard to the improvement of Boston Flats.

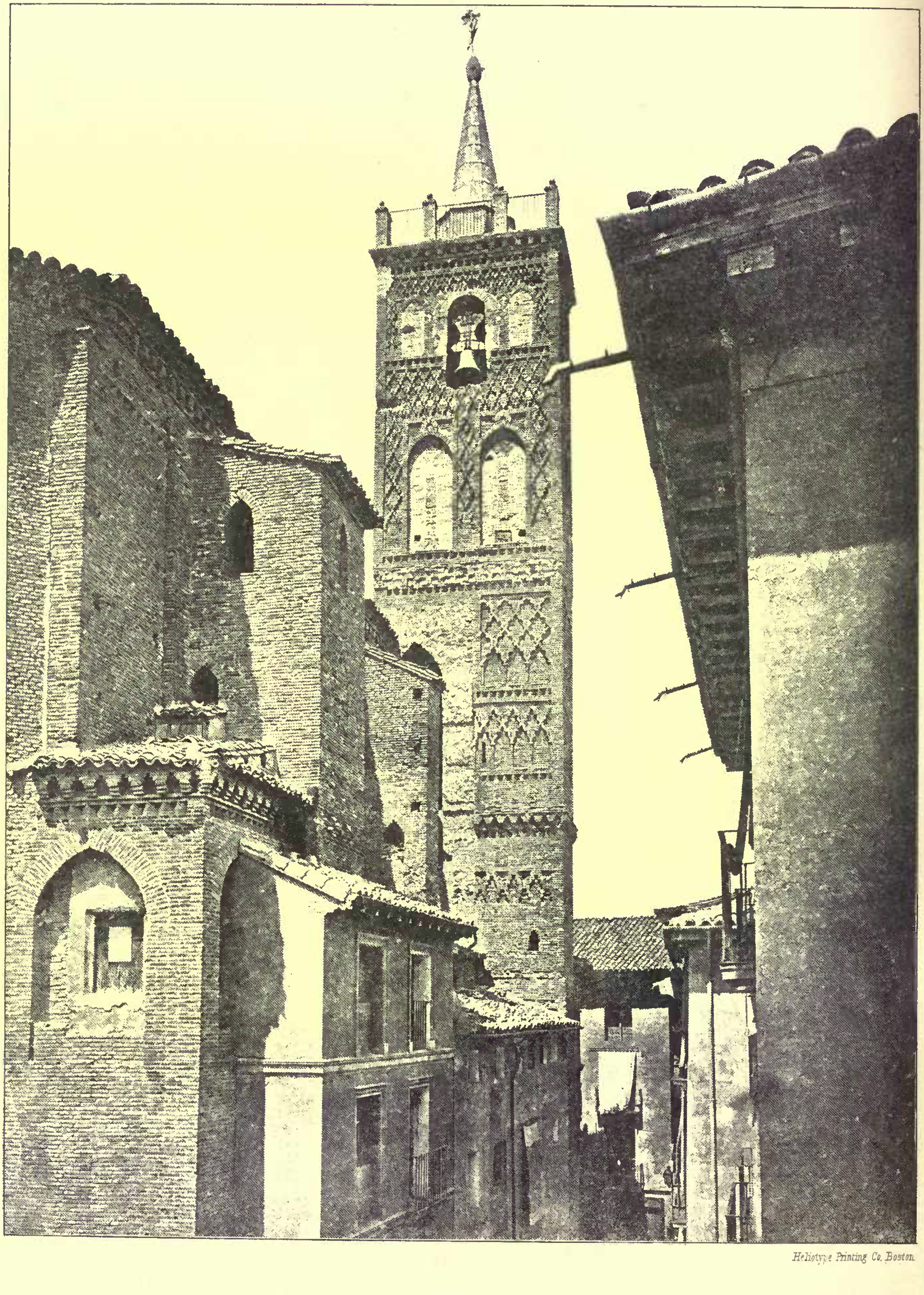
An interesting incident tradition hands down relative to Benjamin Thompson (Count Rumford), is that when the latter was the second time sought to be arrested for being "unfriendly to his country," Colonel Baldwin — his life-long friend — seeing a posse of men halt before his mother's house, directly opposite to his own, went out and invited the men into his barn, where he plied them with liquor till they forgot their errand and went home leaving Thompson unmolested.

OLD COLONIAL WORK IN THE SOUTH, NO. III. — THE BRADDOCK HOUSE, ALEXANDRIA, VA.

This building is interesting, as different portions of it were built at three distinct dates, 1752, 1815, 1852. The first built was the mansion of John Carlyle, who was one of the board of trustees in the incorporation of Alexandria, 1749. A description in the Lodge of Washington tells us that: "The surroundings of this structure have greatly changed since 1752. Then a beautiful lawn extended seventy-five feet to Fairfax Street on its west front, and on the east side the grounds reached to the Potomac river, a distance of about two hundred yards, and across what are now Lee and Union streets. Now, 1875 [same 1887] the old house is hidden from view, except on the

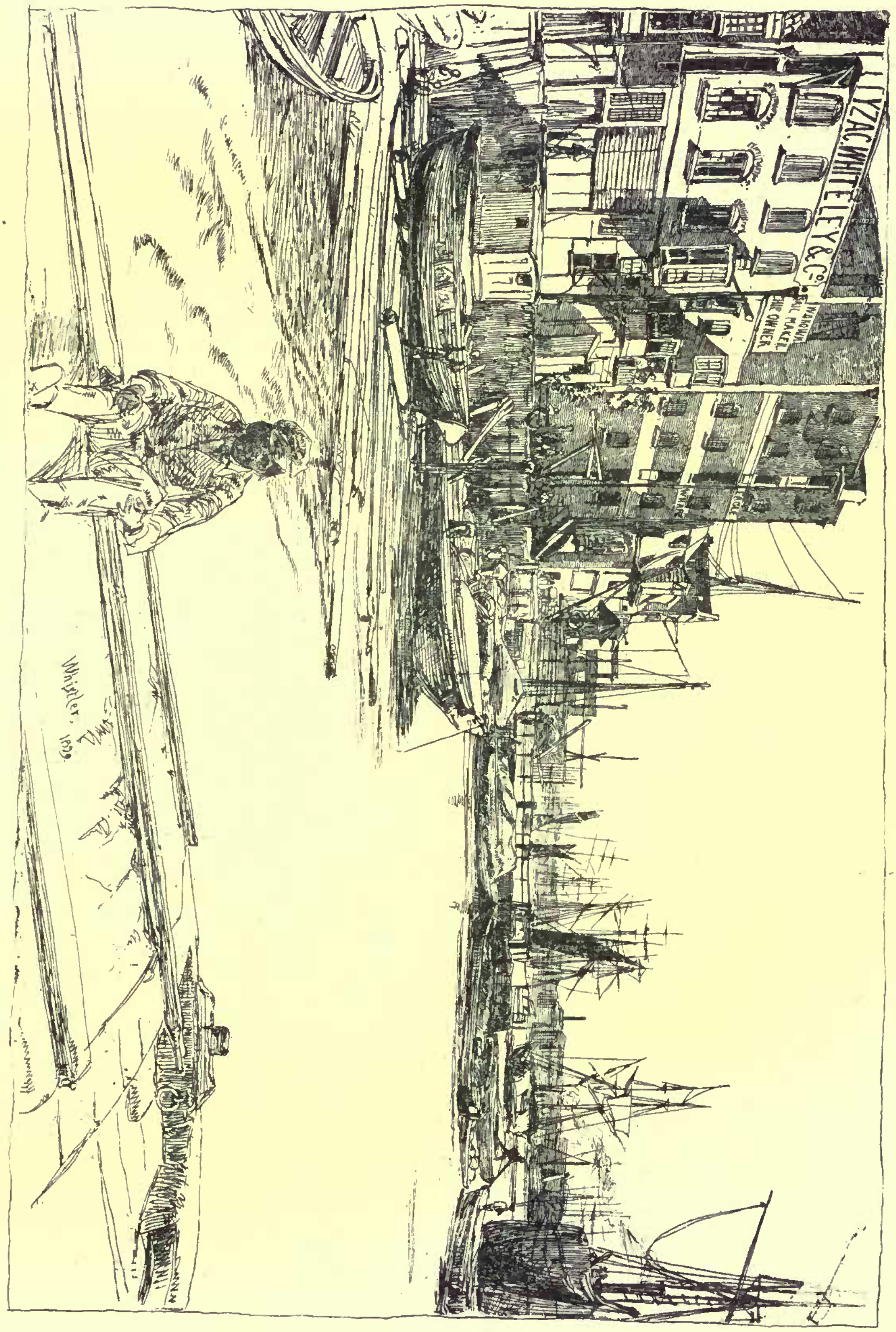


OLD · COLONIAL · WORK · IN · THE · SOUTH



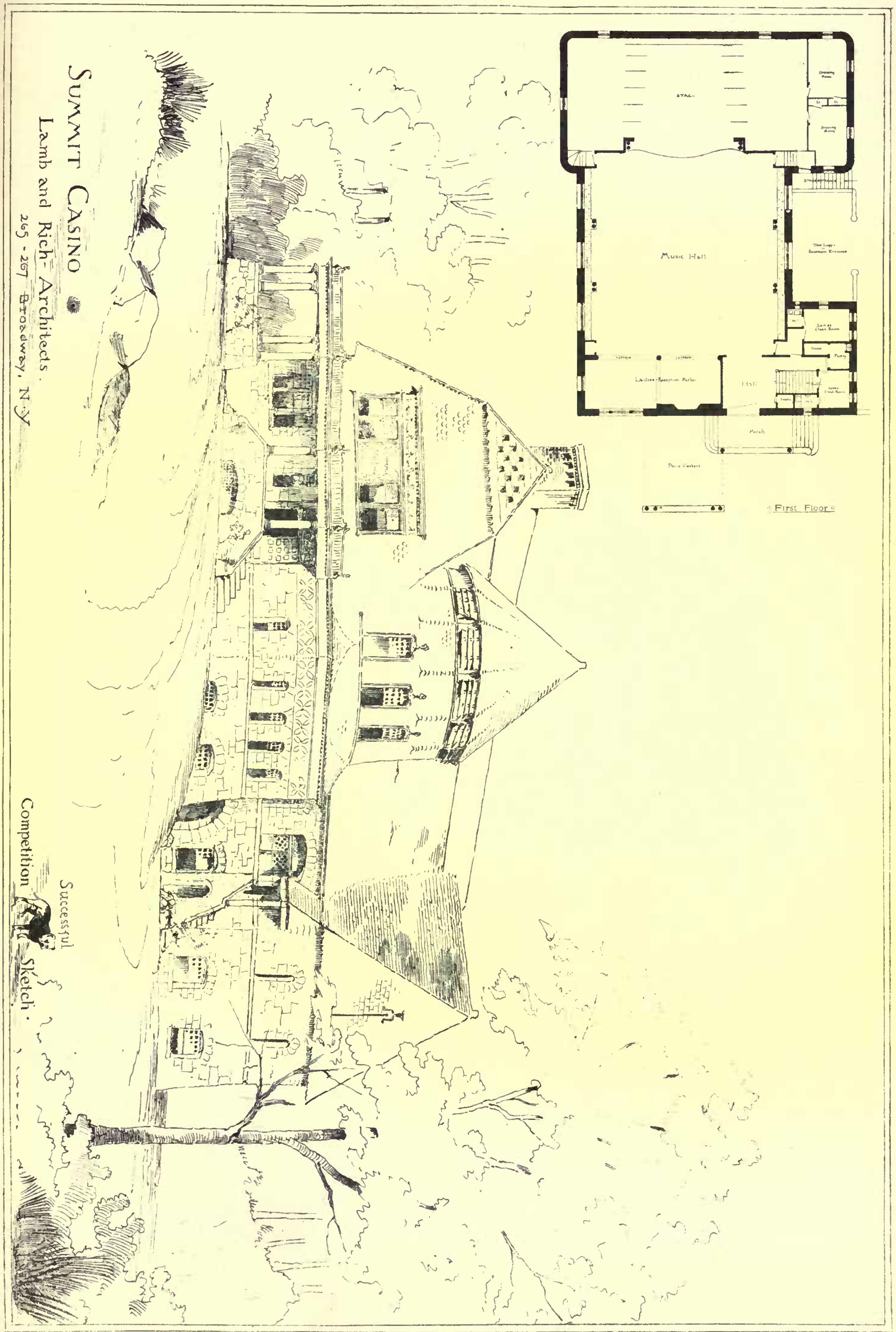
Heliotype Printing Co. Boston.

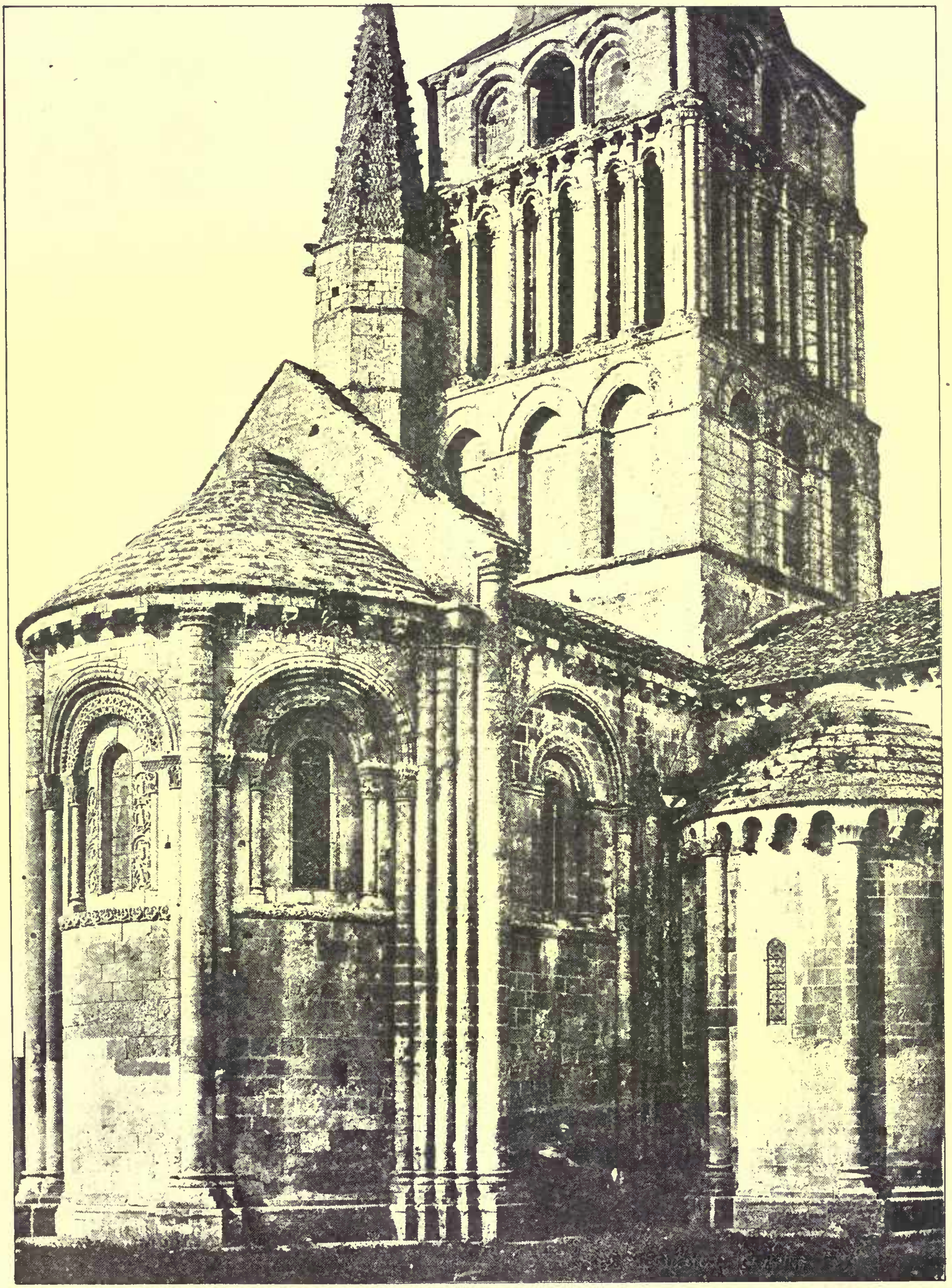
Tower of St. Giles Saragossa, Spain.



Eagle Wharf

Heliotype Printing Co. Boston


Summit Casino
Lamb and Rich- Architects.
265 - 267 Broadway, N.Y
Successful Competition Sketch
Stage
Music Hall
Ladies Reception Parlor
Hall
Porch
First Floor



Heliotype Printing Co. Boston

Aulnay, France.

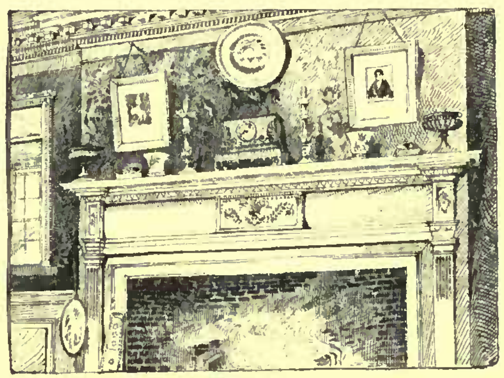
"Old Homstead" of the "Baldwin" Family
North-Woburn. Mass: built 1661.
Summer Residence of Mr G. R. Baldwin.



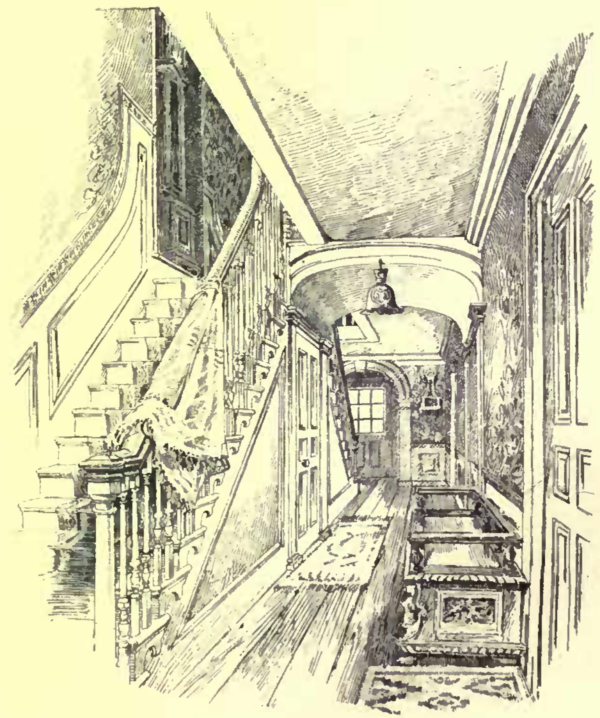
The Approach



General View.



Parlor Mantel



The Staircase.

Sketches by E. Eldon. Deane.

Heliotype Printing Co. Boston.

east side, by the Mansion House Hotel," now called the Braddock House. The house has undergone many changes. The old staircase has been remodelled, all the rooms on the first and second stories, except what is called the Council-room, have been altered. All the doors and sashes have been replaced by new ones, except in the attic.

In what is called the Council-room the following bit of history transpired: "The British Government, having determined to drive out the French and to destroy the power of the Indians, sent over in two ships of war under Admiral Keppel, who commanded the fleet, two crack regiments of the line [the 44th and 48th foot], the 44th commanded by Sir Peter Halket, the 48th by Col. Dunbar.

"These ships arrived at Alexandria late in the month of February, 1755, while the troops remained in encampment until late in April, and were joined by troops from the various Colonies, including two companies of rangers from Alexandria and its neighborhood. On the 14th of April, General Braddock, with Admiral Keppel, held a council with the executives of Virginia, Gov. Dinwiddie; Maryland sent Gov. Sharpe; Massachusetts sent Gov. Shirley; New York sent Gov. De Laneey; and Pennsylvania sent Gov. Morris. Washington was summoned from Mount Vernon, and was presented to the council with great formality. By his dignified deportment and great good sense, made a fine impression, Gov. Shirley characterizing him as a model gentleman and statesman."

The Council-room, with the exception of doors and sashes, is apparently intact. The walls are all panelled, and all the ornamental work is carved in wood. In some places where the paint has been rubbed off the wood is shown to be hard southern pine. All the panels except one are perfect, — neither shrunken nor split. I have illustrated the panelling, cornice, doorway, mantel, etc., from the Council-room.

Braddock was a guest of John Carlyle before his disastrous failure and death in the West. Mr. William Herbert, who married Carlyle's daughter between 1800 and 1815, built a banking-house on the northwest corner of the Carlyle yard for the Alexandria Bank, of which he was president from 1798 to 1818, when he died. The funds of the bank were deposited in the vaults of the Carlyle mansion during its erection. The vaults still remain.

I have illustrated a mantel and doorway from this bank.

In 1852 the structure was completed as it now stands, connecting the old buildings, and cutting the Carlyle mansion off from the street, and adding two or three stories to the bank, and used as a hotel under the name of Green's Mansion House. The latter part of the building has nothing of interest attached to it.

During the late civil war the building was occupied by the United States Government as a hospital, and is now used as a hotel under the name of the Braddock House.

MUSIC HALL, SUMMIT, NEW JERSEY. MESSRS. LAMB & RICH, ARCHITECTS, NEW YORK, N. Y.

THIS design was successful in a recent competition. The auditorium measures 50′ x 50′, finished in pine and painted in white and gold. The ceiling is to be of natural colored yellow pine, with open truss-roof and wrought-iron stirrups and ties. Around the auditorium to be columnated is old colonial with wide divans. The proscenium-arch is to be very wide and flanked by double columns, and the stage is to be 30 feet deep. Above the rear part is a balcony 20 feet wide. The basement includes town library, society hall, and music-room, besides kitchen, etc. The entrance is to be through large archway.

EAGLE WHARF, AFTER AN ETCHING, BY JAMES A. MCN. WHISTLER.

SEE article elsewhere in this issue.

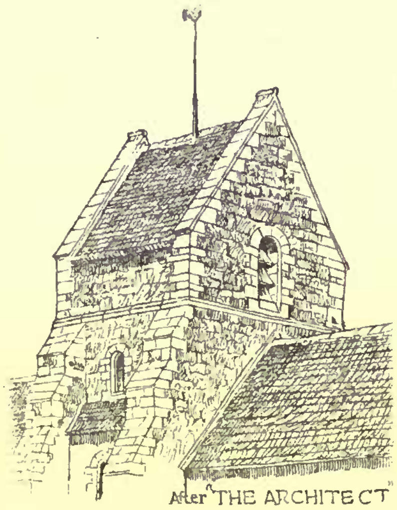
HOUSE OF J. J. MASTIN, ESQ., KANSAS CITY, MO. MESSRS. VAN BRUNT & HOWE, ARCHITECTS, KANSAS CITY, MO.

TOWER OF ST. GILES, SARRAGOSSA, SPAIN.

AULNAY, FRANCE.

THE LONGEST TUNNEL IN RUSSIA. — Russia generally is so flat that the majority of the lines are totally unacquainted with tunnels, which are only to be found in the Polish provinces on the one side of the Russian plain, and the Ural districts on the other; and, more recently, on the railways that are being made in the Caucasus. It is one of the latter that boasts of the longest tunnel in Russia — the Novorossisk branch of the Rostoff-Vladikavkay Railway. This branch strikes off from the main line from Moscow to the foot of the Caucasus range, at a station called Tikhoretsk, and penetrates the Black Sea at the port of Novorossisk. The railway is about 180 miles long and has two long tunnels — one 400 yards long, and the other 1,465 yards. The latter had to be driven chiefly through hard rock, and has been pierced in a little over a twelvemonth. When the rails are laid through it next month the whole line will be open for traffic. Although a tunnel 1,465 yards long is a very ordinary one to European engineers, it has been regarded as quite a triumph in Russia. However, a still longer one is now in hand which will merit more engineering credit. This is the Suram, on the loop-line between Baku and Batoum. The length will be nearly 2 3-4 miles and will cost about a million sterling. The piercing has been in progress for several months now, but it is not expected that it will be finished before 1890 The work is being carried on at the expense of the Government, and when the staff is thoroughly trained it is believed a start will be made on the projected great tunnel through the Caucasus ridge between Vladikavkay and Tiflis. This will be not less than eight miles in length. — *Engineering.*

THE TRAINING OF AN ARCHITECT.[1] — II.



LET us now inquire what advantage the student ought to be able to reap from pupilage and from that kind of extension of it which I have sketched.

First, as to Building, our first head. He will learn little or nothing of their history, and in the ordinary course he will see little or nothing of old buildings, but he will have opportunities in a disjointed way of acquiring familiarity with many of the features, ornaments, mouldings, decorations, and with the general design of the buildings in course of erection by the architect to whom he is articled, and not unfrequently with the design of some ancient buildings, as shown in prints, books, photographs and sketches — Classic, Gothic or Renaissance, according to the proclivities of his master. He ought to have the opportunity of acquiring a pretty thorough knowledge of ordinary construction, and in some cases of special construction, and of learning how to specify and how to make approximate estimates. He will be sure to have opportunities of learning something about materials, but probably most of them will be wasted unless he gains elsewhere some general systematic familiarity with the subject theoretically. He may get some acquaintance with the appearance of buildings in the course of erection, and of course it may happen that he may come in contact with old buildings in course of decay, but this experience is generally reserved for later days.

Passing to my second head, "Familiarity with Men and Affairs." In a large office, a pupil rarely has anything to do with men and not much with business. In a small office, the pupil often has to see people and to devote part of his time to letter-writing, or accounts, and writing out reports, and from all of which engagements he will by degrees learn that valuable familiarity with men and things which we term business habits. If he is at all observant and does his best to make himself useful, and especially if he writes a good hand — a valuable, and, I regret to add, a rare acquisition — he ought to become perfectly familiar with all the ordinary business documents that an architect has to do with, and so when he enters upon practice, this part of his office routine will be at his fingers' ends. Much of the proper dealing with *men* must, however, be learned from his actual responsible contact with affairs in real life.

My third head was "Drawing and Art." If a pupil goes into an office properly prepared, or, at least, well up in drawing the figure, and he has fair abilities, four years ought to make him at least a fair draughtsman. If in four years he thoroughly merits the praise of being a really good draughtsman, he has done well. The routine of preparing drawings from first to last should be familiar to him, and he, generally speaking, will have had an opportunity of making himself acquainted with perspective. Making designs is another matter; it depends upon other things than office work, and will not be learned in the office. As to art as applied to buildings, or as seen in painting and sculpture, if the student is articled to an artist, and artistic work is being done during his term, he ought to gain much artistic training from office work. If (as is often the case) there is little to teach him fine art going on, he has to look for it elsewhere, and he need not look in vain, for many of the best artists in our profession have been brought up in offices where they had little chance of learning the fine art of architecture, though fortunately for them, the technical art of building was learnable thoroughly. If I am correct in the view I have taken, it seems that the student unavoidably, and in the nature of things, is to look elsewhere than to the architect to whom he is articled and the associates with whom he will work in the office, for preliminary preparation and for several important parts of his training.

As for preliminary preparation, it is impossible for an architect to have too good an education, and I wish that every student were a graduate of one of our Universities, but, at any rate, I hope that most will have obtained a thorough English training, with a good knowledge of, at least, one modern language, a fair amount of mathematics, and the elements of some of the natural sciences, that is to say, physics, and, if possible, geology and chemistry, and last, but not least, that he will be well grounded in drawing. It is seldom that a youth or his friends selects architecture for his profession without his having some amount of skill in drawing, but it has rarely been carried far enough. The student should be able to draw the human figure from the antique fairly well, and ought to know something of perspective and landscape. If he has not advanced at least as far as this, it is better to spend some months at a drawing-school before entering an office at all. Some actual work in a joiner's shop is not

[1] A lecture by Prof. Roger Smith before the architectural class, University College, London. Continued from No. 621, page 246.

a bad preparation for pupilage. Whether any part of this which I call preliminary work has to be taken up in addition or not, the following portions of the equipment I sketched a short time back must, it seems, be got elsewhere than at the office. As to Buildings, their history; much of their construction and materials, and science and the superintendence of work. The study of existing buildings. As to Drawing and Art, design and the refinements of draughtsmanship and fine art generally. As to Men and Affairs, all those parts of the conduct of practice which lie beyond ordinary routine, including the law of buildings.

The most important of these is the study of erecting buildings, and I wish with all great emphasis to lay down distinctly the truth — sometimes, I fear, forgotten — that to study the buildings you must go to them. The knowledge about buildings which lectures, books, photographs and prints convey is not a knowledge of buildings. You must see, study and sketch them. There is very great advantage in a student, after a sufficient number of years have been spent in preparing himself, taking a tour, an extended tour, and a continuous tour through as many of the regions of Europe that are architecturally rich as he can, and if it can be extended into the East so much the better. This sort of tour has, I think, fallen in the estimation of students, partly because the facilities for short trips are now so good, partly, I think, because many men during the last twenty-five years have practised little else than English Gothic, and such have been contented to limit their studies to this country, with, perhaps, a visit or two to France, Belgium and Germany. But the star of English Gothic is setting, and the student cannot afford to neglect Classic, Renaissance, Romanesque and Byzantine examples, such as he must cross the Channel to study, and for good reasons which I cannot stop to go into now, six separate trips of a month each do not do one-half, probably less than half, the good that one tour of six months will do. Some building or buildings must at some time be examined very thoroughly. I am disposed to think that the balance of advantage is on the side of comparatively few good examples most thoroughly investigated rather than a large number less completely studied. Each building selected should be measured and drawn out in detail, so that the drawing would suffice to re-erect the building, or the parts of it which are of architectural merit, even if it were burnt. It is obviously convenient in many cases to select some English building for this kind of analysis. Of course, a much larger number of buildings must in addition be less thoroughly treated.

Though I have urged the long Continental tour as desirable—and, let me add, most enjoyable — it must not be supposed that short periods of study of buildings near home are not great helps. Never lose a chance of visiting, examining and drawing good work, old or new. There is a certain amount of very good old Gothic and fairly good old Renaissance to be met with in London, and the best modern work of both sorts here is quite as well worth study as the old, only let it be of the best. London also presents opportunities of studies in museums, of which, I think, few architectural students avail themselves as they might. We have antique work in the British Museum. We have an unrivalled collection of decorative work and Renaissance and Oriental specimens at the South Kensington Museum, where there is also a magnificent series of casts, including many that would form excellent studies for architects. At the Architectural Museum there is a rich collection of Mediæval architecture, and at the Crystal Palace a series of casts and models of every age, the Renaissance, Byzantine and Gothic being very good indeed. In all these places, students who want to wo.k can get leave to draw with very little difficulty.

I now turn to the other points in which the student of architecture requires help. First, I am bound, I think, to refer to that provision which this college has made for assisting him, a provision of which I am proud to say that in the past a large number of men now successfully pursuing the practice, and in later years numbers of men whom I hope to see successful in life, have availed themselves. Those portions of your necessary studies in which you can be helped by attending classes here are, — (1) The history of buildings. This, with an examination into their features, details, and the growth and metamorphoses of architectural styles, forms the subject of the A, or art course here. I do not pretend for a moment to have time, in a session of thirty evenings, or the ability, to tell the students all they require to know, but I claim that the course here gives a systematic and connected view of this history of ancient and modern architecture. I endeavor to make the subject interesting, and prefer to content myself with only taking up as much as can be done thoroughly, rather than to attempt to get over too much ground. There is a magnificent series of diagrams, which are lent to students to work from, as well as hung up in the room, and I have endeavored, with a success of which I confess I am a little proud, to induce the students themselves to draw illustrations of the subjects of the lectures.

"The Materials and the Construction" of buildings form the subject of course B, and here, as in the history of architecture as an art, I am far, indeed, from attempting to cover the whole field; but the course is consecutive, systematic and thorough; it takes up all the principal building materials and how to use them, and I endeavor to make sure work as we go. From both these courses I believe students derive the advantages that they have planted in their minds a sufficiently connected view of the art in the one case, and of construction in the other, for them to be able to appreciate the meaning of every fact which comes under their notice either in their reading or sketching, or on buildings; in other words, that beyond direct gains they are enabled to get advantage from many other sources of information which would otherwise be of less service. I desire to state very plainly that these courses are not so much directed to enable students to pass the examination at Conduit Street as to give them a real help in their education as architects; but I believe that in this way they will more efficiently aid those who are going in for these examinations than if I attempted to shape them exactly to fit the course of the question papers. I think, too, the final examination at the end of the term, and an intermediate one, which it is usual to hold, are of great service to those who are preparing for the Institute examination, by enabling them to see how much they are able to accomplish in answering a previously unseen paper of questions on architecture within a fixed period, and quite without assistance. I am sometimes asked if these courses give enough information to enable students to pass these divisions of the examination to which they respectively relate. My answer is, that it depends upon the student. If he simply attends and takes some notes, and does nothing else — Certainly not. If he attends, and give time and study at home to the subject, and tries to make all that he heard in the class-room his own, and then to pursue the lines suggested for further private reading at points where want of time obliges one to curtail part of a subject — Yes. Not, however, forgetting that personal familiarity with some architectural buildings is absolutely essential to success in the examination. Course C proposes to give such information on the general conduct of building operations and architectural practice, and on some of the laws respecting buildings, as is most needed by men beginning practice, including some notice of the supervision of building works and the decay of buildings, and the measures to be taken to secure dangerous and ruinous structures. Here, again, I think that by giving what is most serviceable to the young architect, I am doing my best for him in his preparation for his examination. Here the work of this college stops; but I have little hesitation in saying that it will help you in the departments to which it is directed to master your subjects more thoroughly than by solitary study you easily can, and that what you will learn in this room is adapted to form the groundwork upon which your own further work may usefully stand.

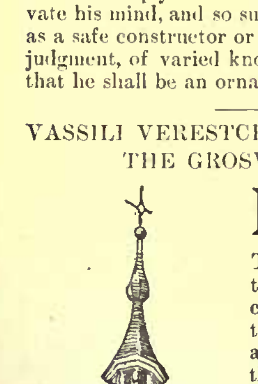
I regret that time warns me that I must condense as far as possible what remains for me to say, and give you bare references in place of stating matters at length. Before leaving this college I must point out that some of the sciences bearing upon architecture can be well studied here, and that the Slade School affords excellent means of instruction in drawing the figure, though in neither case are the courses specially arranged for architects. Some particulars of these will be found at the foot of the prospectus of my lectures. At King's College Professor Kerr gives a course of lectures on the "Arts of Construction." His ability and his long experience as a public lecturer are too well known for it to be requisite that I should say more to point out the value of the course.

The most important subject remaining, "Architectural Design," is to be learned best at the Royal Academy. One must be a good draughtsman to get in; but here not only is good drawing made better under the eye of that accomplished architect and teacher, Mr. Phené Spiers, but design is practised under the personal direction of the very first architects of the day, those I mean who have the honor of being members of the Academy. No opportunity so good as this exists, and no better opportunity well could be devised for students to acquire skill in design; and quite apart from the medals and prizes, this is enough to repay you for any trouble taken in obtaining admission. Next, I must refer to the Architectural Association and its work, a subject so considerable that I cannot do more than glance at it in general terms. A student's mutual improvement society, numbering about 1,000 members, with a library and at least a dozen classes and courses of lectures, and its own travelling studentship and series of valuable prizes, it is an organization of great importance and with vast possibilities for good. I hope you will all belong to it, for from it individual portions of your architectural equipment can be well obtained. It is sometimes said that there are imperfections connected with the scheme of the Association, the most serious being that the work is to a certain extent fragmentary, and in the nature of things unequal, and that some of the amateur teachers are not practised instructors. Whether this be so or no, the facilities offered are very many and very great, and especially so in that all-important branch of your studies, the study of design. The elementary class of design, the class of design, and class for color decoration are worthy the attention of you all as open to you before you can enter the Royal Academy, and to these classes many an architect is indebted for his first opportunity of learning and practising design. The practical side of our art is studied by the members of the Association in many classes, each good in its way, and each taking up a useful portion of the work. The visits to modern buildings, which are organized by the Association, are a means of learning how the best work of the present day is being done, and in themselves would be worth joining for. In the "*Brown Book*" of the Association you will find the whole programme set forth, and there, too, you will find the regulations and programmes of all the other organizations which I have alluded to. Let me recommend to your notice the page of advice to students which that pamphlet contains, and to your practice the personal consultation with a member of the Committee of Advice which it suggests and

recommends. Among the announcements in the "*Brown Book*," one will appear for the first time which I should be glad to believe will be continued for many years — the Studio established by Messrs. Baggallay & Millard. This new and as yet untried venture, is fortunately in good hands, and if proceeded with, ought to afford admirable assistance to students in draughtsmanship and design, and I hope also in construction. The Royal Institute of British Architects does not give any courses of instruction, but it possesses the best architectural library in London, and this is now accessible without charge and without more than the needful formalities to all working students of architecture, including students at this college.

The City and Guilds Institute has given in the month of July short courses of lectures on subjects, most of which are of value to architects. These, no doubt, will be repeated next summer. The establishment at this Institute of various classes bearing on our pursuits is in contemplation, meantime a class of exceptional instruction in masonry was conducted there last session by Mr. Harvey, and this subject is to be pursued together with the allied subject of descriptive geometry, under the same teachers this season. The instruction given by Mr. Harvey is spoken of by those who know most about it as exceptionally good, and there is nowhere else where the same subject, treated from an architect's point of view, is taught so thoroughly and practically. Here I might well end, were it not that I know that this address, or much of it, will, by the courtesy of the professional press, be read by students who cannot get to London, or who, being in London, cannot see their way to getting to Gower Street or Conduit Street. To any such I should like, with your permission, to address a parting word, and to say, "Courage, my friend. Remember, it is 'the spirit in the man, not the water in the brush;'" and though I have spent the evening describing useful aids to study, there are few of them which a resolute and energetic student cannot dispense with. What I take to be absolutely essential is, first, work in an office, and that I take it you have; secondly, buildings to study, and there is hardly a parish in England where there is not at least a fragment of the noble Mediæval architecture of our country within your reach; thirdly, books, and of those you must manage somehow to get hold of a few, but if your choice be not large you must the more thoroughly master the ones you have; and lastly, instruction in drawing. That happily the schools of art have spread through the country. Read, I pray you, the "Advice to Students," issued by the Institute of Architects, and appended to the programme of the examinations, and you will notice that there is but scant reference to the London advantages which I have dwelt upon, though I have good reason to think that the Board of Examiners are not insensible to their value; but that the course pointed out is one which a student, with comparatively little aid, may fight out for himself. Still, I am quite sure that the aid offered here and elsewhere will make that course easier, shorter, and I think, surer. In taking leave of the subject and releasing you, let me revert to what was said earlier in the evening upon cultivation. I trust that each one of you will not simply learn his profession and push his way, but will cultivate his mind, and so successfully that he shall be known, not merely as a safe constructor or a brilliant designer, but as a man of taste, of judgment, of varied knowledge, of some accomplishments: in short, that he shall be an ornament to his profession.

VASSILI VERESTCHAGIN, THE RUSSIAN PAINTER AT THE GROSVENOR GALLERY, LONDON.



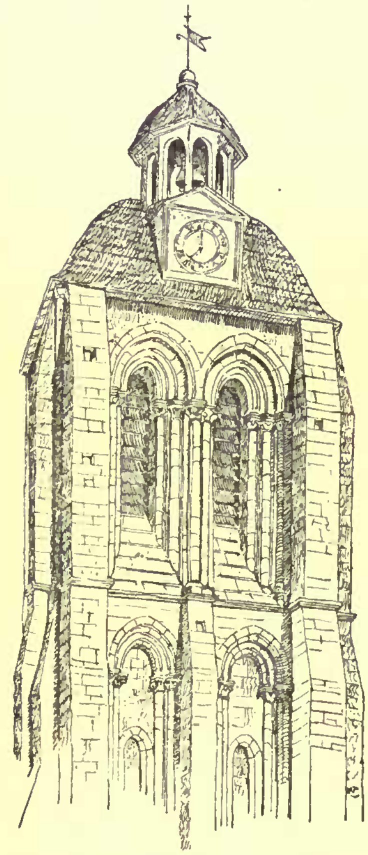
EVERYTHING that could be done to show off M. Verestchagin's pictures to the best has been done at the Grosvenor Gallery. The walls are hung with dark-red cloth festooned, the doors have *portières* of Oriental carpets; there are trophies of arms here and there, and tropical plants everywhere. It is all most artistically arranged. You look through an avenue of evergreens at the court-yard of a mosque. Just in the centre is a palm, and another at the side. Half close your eyes and it seems as if you were standing in the court under a blazing sun looking at the Indians at their prayers. Some of the realistic critics will doubtless call this claptrap, but there is no reason why a picture-gallery should not have its corners filled up by evergreens, and its walls hung with festooned drapery. Everywhere but in England this is common enough, and it certainly adds to the pleasure of looking at pictures. Now and then, to refresh one's eyes by gazing upon the harmonies of an Oriental carpet detracts nothing from the beauty of a picture; and were it not for the expense, every great gallery would be improved by draped walls, or embossed leather; for there is not a picture, however great, that is not improved by luxurious surroundings. The popularity of M. Verestchagin's exhibition will probably rest upon his battle-pictures, which are realistic to the last degree. The painter has served in the Russian army; he has seen war from the private's point of view; he knows the miseries of cold, and wet, and burning sunshine; and yet, in spite of one's feeling that it is all perfectly true, somehow or other this manner of painting carnage does not impress one. How is this? Is it too realistic? When first I became acquainted with M. Verestchagin's work in Paris, I had the opportunity of comparing it with the great French military painters, such as Détaille and De Neuville. They, too, had served in as dreary a campaign as the Russo-Turkish; the cold in the trenches of Paris may not have been quite so severe as that in the Balkans; but once the thermometer descends to twenty degrees below freezing-point, a few degrees more or less is of little consequence. Comparing these various horrors, De Neuville's and Verestchagin's, my impression eight years ago was the same as it is now — that the Frenchmen are pathetic, and the Russian is only horrible. Few people can gaze untouched at De Neuville's "Le Bourget," or "St. Privat"; but out of all M. Verestchagin's pictures only one, to my mind, is in the least affecting — the "Blowing Rebels from the Guns in India" — and this, perhaps, disgusts more than it touches one. There is a want of the pathetic in all this Russian's work; the string of carts toiling along full of wounded men ought to be pathetic, but it is not, although there is always an heroic element in French battle-pictures which, I dare say, is not half so true as the absence of it in this Russian painter's work, yet they make one feel more the brutality of war than do M. Verestchagin's. His men are not living souls, they are puppets — which probably is the fact. Still, the only *raison d'être* for painting military subjects can be to stimulate heroism, or give a wholesome horror of war, and these pictures seem to me to do neither. There is any amount of blood; there are limbs tumbled about, but the result does not make one shudder. The work is, in fact, too realistic, and not sufficiently artistic; it is just the difference between the realism of Zola and the realism of Alphonse Daudet — there is a lack of the pathetic. Take the picture of the "Forgotten Soldier," left dying amongst some verdure which is conventionally arranged into a jungle (utterly unreal), with a background of snowy peaks, a deep-blue sky, and birds of prey (stuffed birds), hovering above. The whole thing is made up. Compare this with "Oublié," by, I think, De Neuville; a soldier, wounded, is crawling on the snowy ground endeavoring to attract the attention of an ambulance passing along in the distance. The first picture is, as I said, made up in the studio; the second might have been painted on the spot. You pass the first picture with a single glance; you stand immovable before the second until the tears start from your eyes. Even "Conquered" fails, although it ought to be pathetic — a priest censing a number of dead. The priest's expression is fine, but the dead men are a mere confused mass lying in the grass, which you might not even see if you did not look for them.

But turning to the Indian pictures, a very different judgment must be passed. These, for light, intense sunlight, have never been surpassed, never been equalled — in fact, M. Verestchagin is the only painter who has ever been able to impress the spectator with the effect of Oriental glare. De Nittis and some of the modern Italians and Spaniards have a wonderful power of rendering sunlight, but the palm must be given to the Russian painter. "The window of Selim-Shisti's monument" is a marvellous effect of light. A white marble wall, with beautiful, carved open-work window, a white marble seat, and on it, men clad in white; the only color, a frieze of glazed tiles, and yet the brilliancy of light and the power with which the Indians stand out against the wall are perfect. So, too, the "Pearl Mosque in Agra" is an exquisite study of different tones of white. "The Mosque in Futtehpore Sikri" is equally fine, with its many-colored walls and reflections on the marble pavement. Note, too, the characteristic attitudes of the Indians, their slim, lithe figures and long feet. "The Taj, at Evening," with the sunset glow upon it, and the same, rising from the morning mists, are both excellent studies. "The Prince of Wales entering Jeypore" is a blaze of color and very interesting as an historical picture, but artistically it is somewhat hard and wanting in breadth. Amongst the pictures and sketches in Palestine are many as excellent as the Indian ones. "Solomon's Wall" is very rich in color and far superior to the same subject painted by Gérome years ago. Nor must "Business and Prayers" be omitted, two Jews in rich raiment discussing "affairs." Another splendid study of color is a nameless picture of a Central Asian of Khiva or Samarcand (?) clad in a thick, many-colored garment, standing against a white-tiled wall. The lower part is blue and green of Persian character, and here and there some of the tiles are broken. The whole is most powerful. The "Tombs of the Kings," the "Entrance to the Grotto of the Mount of Temptation," and the "Refectory of the Grotto," are all worthy of minute study.

M. Verestchagin is certainly one of the first painters of the day. He is original, powerful, and a brilliant colorist. His least successful works are the portraits, though some of these are also exceedingly clever. If these battle pictures will put an end to, or even stay war for a time, so much the better, but I fear not "in our time," as M. Verestchagin says in his catalogue, but so long as the world lasts "people will kill one another, everywhere, under all possible pretexts, and by every possible means. Wholesale murder is still called *war*, while killing individuals is called *execution*." M. Verestchagin ought not to be surprised at this. Man is before all things a sporting animal, and if he cannot slay his fellowmen, he kills the lesser beasts, hares, rabbits, birds, and sometimes human babies, but still to his credit be it said, now and then he does not mind running the risk of being killed himself. Also, we ought to admit that without war, the world (the older parts of it), might become still more unpleasantly full than it now is, though, as a mere population-thinning machine, perhaps a good epidemic is less brutal. In any case,

M. Verestchagin has done his best to depict war with all its *horrid* accessories and in its most intense brutality. Penguin.

JAMES ABBOTT McNEILL WHISTLER.



TOWER of S MARTIN, TOURS
AFTER "THE BUILDING NEWS"

Mr. WHISTLER was born in several places, according to his own statements and those of others; in the "*Salon Catalogue*" of 1882, he is vaguely but magnificently termed "Neill Whistler, born in the United States of America" — but I believe the fact to be that he is a native of Lowell, Mass., where he "arrived" in 1834. His father was George Washington Whistler, an eminent civil engineer, who held a place of high honor in Russia in connection with the building of railways. To that country our Whistler was taken when a child, but his father dying, he returned to America, and was sent to West Point to receive a military education. He is described as having been very inattentive in his studies, so much so that he failed to pass the examination, and was dropped from the rolls. It is to this period, doubtless, that the following anecdote related by Wedmore, belongs. "There exists, somewhere or other in the too-safe keeping, of public authorities in America, a plate on which, before he left the public service of the States, he neglected fully to engrave that map for the coast-survey which the authorities expected of him, but on which he did not neglect to engrave, in truant mood, certain sketches for his pleasure. The plate was confiscated. Young Mr. Whistler was informed, sternly, that an unwarrantable thing had been done. And he perfectly agreed, he told the high official, with that observation — "an unwarrantable thing had been done: it was quite unwarrantable to remove a plate from the hands of its author without sufficient notice: he had thereby been made unable either to finish his map or to remove those sketches which were meant only temporarily to enliven and ornament it." It was plain that he would never make a soldier, so he abandoned the profession of arms and followed his own strong artistic bent.

This took him first to England (in 1855), and later to Paris, where he entered the studio of Gleyre. Here he remained about two years, and during this time published his first set of etchings — twelve plates and a title — usually called the "French Set." They were renderings of street scenes, interiors and figures, and were published by Delâtre in 1858, with a dedication to Seymour Haden. It was a few years after this time that his first important picture, "The White Girl" (1862), was painted. It was, however, rejected by the jury of the *Salon*. Then he went to London and settled in Chelsea, that fascinating old place which he has always since loved, and with which his name will be as closely linked as those of Rossetti and Carlyle.

His earliest contribution to the Royal Academy, "At the Piano" (1867) was a success, and was bought by John Philip. His "Arrangement in Black and Gray" (1872) (the famous portrait of the painter's mother) was not so fortunate, being at first declined, but was finally hung, after a strong fight for its acceptance made by Sir William Boxall, R.A., of the Council. Whistler sent pictures to the Royal Academy for a number of years, among which were "Symphony in White, No. 3," and "The Last of Old Westminster." But he has not exhibited there for a long time now.

During the years 1859–1861 he had etched a series of views on the Thames, sixteen in all, which form what is called the "Thames Set," and may, on the whole, be considered his finest etchings. Their subjects were picturesque shipping, boats and barges, old wharves and warehouses, and some of the bridges. They were not, however, publicly issued until 1871. Strength combined with delicacy, the art of saying much with little, and a great mastery of telling lines are their chief and sufficient charm.

In 1874 he opened a special exhibition of his works in London, which attracted much attention, and with the exception of the pictures he sent to the Grosvenor Gallery and an occasional portrait shown at the *Salon*, he has since confined himself to this method of reaching the eye of the public.

The Grosvenor Gallery was opened by Sir Coutts Lindsay in 1877, and one of the largest contributors was Whistler, who sent his portrait of "Irving as Philip II," with some "Nocturnes" in black and gold and blue and silver, a "Harmony in amber and black," and an "Arrangement in brown." For the painter had now adopted some of the terms of the musician in order to give distinctive titles to his work, and yet avoid any literary flavor, which he has always disliked. Whistler does not believe that pictures need teach any lesson or that they should illustrate any event, either fictional or real. He is an "impressionist" in the real sense of the word, painting the essences of things as they present themselves to him. "Never depiction; always suggestion," is his motto. His coloring and harmony of tone are those of a master, and while looking into the mysterious hues in which he veils his work, one does not ask for more from him. Velasquez is the painter who has most influenced him.

His initial contribution to the Grosvenor Gallery was followed by a "Variation in flesh-color and green," and a "Scherzo in blue," and portraits of Miss Rosa Corder (otherwise called "An Arrangement in brown and black") of Miss Connie Gilchrist, the actress ("The Gold Girl") and Lady Archibald Campbell. I must also record here his fine portrait of Carlyle (1872) now of world-wide reputation, one of Miss Alexander, a portrait of himself, and a most striking one of Sarasate, the violinist. This last was exhibited in 1885 at the Society of British Artists, of which Mr. Whistler became a member in 1884, and was elected President last year. His portraits of Carlyle, Mrs. Whistler and Miss Corder have been engraved in mezzotint.

It was in 1878 that, because of some sharp words used by Mr. Ruskin in a review of Whistler's paintings at the Grosvenor, the latter brought a suit for libel against the great art-critic. Mr. Ruskin, among other things, had said: "I have seen and heard much of cockney impudence before now, but never expected to hear a coxcomb ask 200 guineas for flinging a pot of paint in the public's face." The trial made a great sensation, and many noted artists were called to testify as to the merits of the work in question. It ended in a decision giving Mr. Whistler one farthing damages and no costs. After this celebrated case was over, he published a pamphlet on the subject, called "Art and Art Critics," giving his views upon lay criticism, holding that the only judgments worthy of respect were those expressed by artists. Whistler's pen is not much less brilliant than his brush, and many caustic and pointed things are said in this little *brochure*. He says of his opponent, "We are told that Mr. Ruskin has devoted his long life to art, and as a result — is Slade Professor at Oxford. In the same sentence, we have thus his position and his worth. It suffices not, Messieurs! a life passed among pictures makes not a painter, else the policeman in the National Gallery might assert himself." Again, "Still, quite alone stands Ruskin, whose writing is art and whose art is unworthy his writing," and "as master of English literature he has a right to his laurels, while as the popularizer of pictures he remains the Peter Parley of Painting."

In 1881, Whistler arranged an exhibition in London of his pastels of Venice, and in 1884 and 1886, a number of his drawings and sketches were gathered together by him and shown to the public. On these occasions he decorated the galleries in harmony with the prevailing "note" of the collection, at one time displaying "an arrangement in flesh-color and gray," at another, "an arrangement in brown and gold." He was one of the first to appreciate and introduce the beauties of Japanese art-work.

Mr. Whistler has done some notable work in decoration. In 1877 he executed his famous "peacock room" (see *American Architect*, March 24, 1877) in blue and gold, in the town-house of Mr. F. R. Leyland (London), whose portrait, with those of his wife and daughters, he had etched some years before. His decorative work is found in other London houses and in the music-room of his friend Sarasate in Paris, which is in a scheme of white, pink and yellow.

Rare and original as are Mr. Whistler's talents as a painter, it is his etchings by which he has won his chief fame and on which it will doubtless rest. His strongest admirers claim that he is the first living etcher, and they have good ground to stand on. Besides those already mentioned, he issued in 1880 a set of twelve prints of Venice, and in 1886, a second series of twenty-six plates, twenty-one of which were of Venice, and he has produced a large quantity of single plates. Some of them are "Joe," "Finette," the "Little Putney," "Battersea Bridge," "The Adam and Eve," "Old Chelsea," "The Muff," and "Speke Hall."

Mr. Frederick Wedmore's catalogue, published in 1886, enumerates two hundred and fourteen etchings, the work of thirty years. Many of the prints are now exceedingly rare. Mr. S. P. Avery, the well-known New York picture-dealer, owns a very fine collection of Whistler's etchings and paintings. In 1883, the artist exhibited, at the rooms of the Fine Art Society in London, some fifty etchings and dry-points of Venice. The gallery was decorated in yellow and white — the room white, with yellow mouldings, the frames white, the chairs white, the ottomans yellow, curtain and mantel draperies yellow, with white butterflies, yellow flowers in yellow Japanese vases — even the attendants were clothed in white and yellow. As a well-known French artist said, "It was a dream of yellow." And the catalogue, the work of Whistler himself, was another revelation. After each title he had quoted criticisms on his work (mostly unfavorable) from the writers and journals of the day. For instance, after No. 27, "Nocturne Shipping," he quoted from the *Daily Tele-*

graph, "This archimago of the iconographic aoraton, or graphiology of the Hidden," and writes in the margin, "Amazing!" After No. 36, "The Mast," he put, "The Mast and the Little Mast are dependent for much of their interest on the drawing of festoons of cord hanging from unequal heights." This was from P. G. Hamerton, and at the edge Mr. Whistler notes, "At the service of critics of unequal sizes." Against the words of Wedmore, "He took from London to Venice his happy fashion of suggesting lapping water," which were printed under No. 30, "Riva," he printed "Like Eno's Fruit Salt," or the "Anti-mal-de-mer." He headed the list of prints with, "Out of their own mouths shall ye judge them," and "Who breaks a butterfly upon a wheel?" and ended it with

"*Voilà ce que l'on dit de moi*
Dans la Gazette de Hollande," and
"We all roar like bears."

At another time, when *Punch* had published some caricatures of his drawings, the eccentric artist cut them out of a number and gravely hung them up in the gallery beside the works which they burlesqued. Courage, independence and humor are prime qualities of Mr. Whistler, and much shall be forgiven him for them. He is not renowned for consistency — indeed, he would no doubt scorn such an imputation — and those who know him were not surprised when he advocated using no margins or remarques on etchings and yet used mounts of extraordinary size (his etchings being all small), and also left on the lower edge of each print a projecting bit of paper with his monogram upon it.

In 1885 he lectured in London on art, presenting his hearers with a brilliant and novel discourse, commencing to deliver it at ten o'clock in the evening: he explains why, in this characteristic way, "Every dull bat and beetle spouts at eight o'clock, just as we are about to sit down to dinner. So we never go to see Bat and Beetle. I shall lecture at ten in order to dine myself, and let my victims get through with dinner." Perhaps Mr. Whistler thought his audience would be more good-natured after dinner.

Numberless bright things are attributed to him. One is of Sir Frederick Leighton, the president of the Royal Academy, whom some one had been praising for his versatility. Whistler quietly said, "and he paints a little, too, I believe." Another relates that an enthusiastic disciple of Whistler had said to him that, after all, there were only two great painters, Velasquez and Whistler. "Why drag in Velasquez?" Whistler remarked.

The irreverent spirit of the nineteenth century might suggest that Whistler would have been the Napoleon of advertisers but the world would have lost an artist that it could ill spare. Such vivacity, elegance and charm it seldom greets in one personality. Wit and conversationalist as he is, Whistler is also said to be much of a Bohemian.

The late E. W. Godwin, the architect, in 1879 built for him a house in Tite Street, Chelsea. It was a quaint little structure of white brick, and gained the name of the "White House." It is said that it was sold for debt, and when Whistler moved out of it he wrote on the wall, "Except the Lord build the house their labor is but vain that build it. E. W. Godwin built this one." The house was afterwards occupied by Mr. Harry Quilton, once art-critic of the *Times* and *Spectator's* who said some severe things of Whistler's work, and whom the artist delights in quoting as "'Arry." Whistler now lives in the Fulham Road in London, in a beautiful house, with a large studio, very plain in its furnishing, almost its only ornament being some fine old blue-and-white china.

Whistler's personal appearance is as striking as his work. He is tall and straight with a handsome face and fine head of curly black hair, in the midst of which is the famous "white lock." He wears in one eye a glass without a rim, and habitually carries a long, wand-like cane, and it is said that this cultivator of originality once declined to give it up to an attendant at an exhibition, saying "Oh, no, my little chap! I keep this for the critics."

His signature or hieroglyph, which bears a resemblance to a butterfly, is, in its oddity, characteristic of its owner.

Whistler has won a medal for painting at the *Salon* and one for etching at The Hague.

It has been reported that he was coming to America to lecture, but his visit has been put off from time to time. His explanation is: "It has been more than once suggested to me, but you see, even as it is, I find art so absolutely irritating in its effect upon the people that I really hesitate before exasperating another nation."

His influence upon young artists both in painting and in etching has been wide and powerful, and whatever the faults of his work, they cannot hide its great merits nor detract from the fact that we have in him an artist of the first order, a thorough *painter* and a great etcher.

THE DECORATIONS FOR THE HOTEL DE VILLE, PARIS. — The select committee of artists, town councilors, and high civic functionaries which was named last July to decide on a plan for the pictorial decoration of the Hôtel de Ville are to go to-morrow to study at Fontainebleau the models created by the Italian masters engaged to adorn the palace there by Francis I and Henry II. It is probable that these models will be adopted for the reception-rooms at the Hôtel de Ville. The decorators are not only to have recourse to pictorial artists in beautifying the galleries there, but to make extensive use of the tapestries belonging to the City of Paris. — *London Daily News.*

COMMUNICATIONS

DRY-ROT AGAIN.

CHICAGO, November 16, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — Is there any danger of "dry-rot" in the truss-work of an open timber roof where the timbers are finished with three coats of "hard oil finish." The roof in question is that of a church, lately finished in this city. The material of the trusses is Georgia pine, the largest timbers being 12″ x 14″ in size. It was necessary to finish the work in some way as the entire roof-work is of wood, panelled between the trusses and purlins — all of which are fully exposed. The timbers were as dry as such large pieces usually are when put up, which is, perhaps, not saying much. "T."

[WE should be anxious about these trusses. The dryness of the situation may not save them. One of the worst cases of rot we ever saw was in a timber lying on the floor of a dry garret. In this case the disease had apparently started from the point of contact with an upright shore which stood on the horizontal piece; and if it should begin at a joint, or at the foot of the truss, which is commonly the starting-point in such cases, it would run very freely through the material prepared for it in the cells of the wood by confining the sap with varnish. — EDS. AMERICAN ARCHITECT.]

ISOLATED WATER-TANK TOWERS.

NEW YORK, November 18, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — Permit the suggestion, in connection with the general use of automatic-sprinklers, with the tank elevated, as now in vogue with so many manufactories, that, architecturally, the form of light-houses be adapted, when on level ground it becomes necessary for a special detached, or partially-detached structure. Also, where great height is necessary, with open inside, from base to roof, would commend the arrangement made by the De Wit Wire-Cloth Co., at Belleville, N. J., for drying painted screen-wire with a vertical dryer. In the case of elevated tanks for sprinklers, outside pilasters or buttresses might be curved to give the batter of the light-house form.

I do not know the architect of the De Wit Company, but possibly it might serve as a suggestion to architects. The idea is a tall column at end of the property, tapering to a considerable height, then swelling and with windows at the top; about fifty feet square at the base. X.

NOTES AND CLIPPINGS

HOW A MILL-ENGINE WAS SAVED. — A very singular incident was noted in connection with a recent mill-fire in Carlton, Mich. The building was burning fiercely, but the big engine which drove the machinery continued to run all through the blaze, and by that means was saved from destruction, though there was not a wall standing on any side of it when the fire had finished. The pumps were also running, and kept the boiler supplied, so that there could be no explosion. It was a peculiar spectacle to see the engine driving away at a slashing speed in the midst of the flames, but the motion somehow saved it from fire. All the rest of the machinery was a total loss. — *American Miller.*

A TIDAL ENGINE. — "After many accidents and trials," says a San Francisco paper, "the wave-power motor, so long talked of, has at last been finished and proved a success. The construction of this machine, or apparatus, which was begun in July, 1886, was at the time considered a hair-brained scheme, but the projectors stuck to their plan, and seem now to be in a fair way of success. Great difficulty was experienced at first in getting the materials to withstand the force of rocks thrown against them by the waves, and the pipes which conduct the water up the bluff were broken and carried away no less than fourteen times. When the schooner "*Parallel*" went ashore and her cargo of dynamite exploded, the motor was completely wrecked. A mass of rock weighing 600 tons was thrown from the cliff and fell across the cavern over which the motor was suspended, blocking it up to such an extent that nearly three months were consumed in blasting out the debris. Soon afterwards another mass of stone, weighing 150 tons, fell, and had to be removed. The motor, designed and built by Mr. E. T. Steen, is a very simple contrivance, and still is capable of exerting a great power. Across a chasm in the rocks just north of Parallel Point a bridge of heavy timbers was built. Suspended from this is a huge fan or paddle of oak timbers, with the spreading portion downward. This is fastened to the bridge by immense hinges, which allow it, when in operation, to swing back and forward a distance of 36 feet as the waves strike it. The handle, or upper portion of the fan is connected with a solid plunger-pump 12 inches in diameter, and having a stroke of 9 to 12 feet. This pump, in turn, is connected with a suction-pipe running out into deep water. The fan is so rigged that it can be drawn up out of reach of the waves when not in use. When a wave comes in the fan is thrown forward and forces the air out of the pump-barrel in which the plunger works. On the wave receding the fan is carried seaward and the plunger is drawn out, causing a vacuum, and causes a quick rush of water into the suction-pipe. The force with which the water is drawn up is sufficient to raise it to an elevation of 350 feet above the tide level. Should this motor prove as successful as the pro-

jectors seem confident it will, several others will be built in the same neighborhood, and an immense reservoir built on the hill to contain the water. This one motor, with its 12-inch plunger, is capable of raising 12,000 cubic feet of water 350 feet high in every twenty-four hours. The uses to which the water will be put are valuable. A 36-inch pipe will be conducted to the city, and water will be supplied to all branches of industry where machinery is used. Bathing-houses will also be supplied with salt water, and sewers when it is necessary. The immense fan of the motor generates a large amount of energy not used in working the pump, and when everything is in shape electric dynamos will be erected to utilize this energy for heating purposes and the like.

Raising an American Obelisk. — Although the production of large monolithic obelisks has been peculiar to the Egyptian race, yet there has been something in the elements of solidarity peculiar to the designs of these monuments that has proved an attraction to all European nations, and these monuments of a dead civilization have been borne from their resting-place on the Nile to grace the cities of modern civilization in Europe, and even in the metropolis of America. There has been recently produced in America an obelisk which is worthy of note from its size being the eleventh in point of dimensions of those thus far known; but it is not the archæological conditions of the past age that we have to consider, but the adaptation of modern engineering in dealing with an ancient problem. There were some conditions of considerable difficulty in connection with this obelisk, rifted out of granite in a rocky island on the coast of Maine. It was towed upon a barge 500 miles to the city of Troy, on the Hudson River, 150 miles north of New York, whence it was moved upon rollers for two miles, ascending 800 feet in that distance. The obelisk was 60 feet in length, weighing 100 tons, and rested upon a die 9 feet square and 6 feet high, weighing 40 tons. The base was 17 feet 6 inches square and 2 feet high, the whole height of the monument being 75 feet 6 inches, and its total weight reaching 250 tons. The great engineering feature of the monument was the method used in its erection, which was accomplished without the use of shears, derricks, or other devices commonly used in connection with such work. When the monument was hammered out two trunnions were left on opposite sides slightly above the centre of gravity, projecting about 4 inches, and measuring 2 feet 6 inches across. Timbers 14 inches square were secured to the monument under these trunnions, and smaller timbers near the ends of the obelisk were secured to the monument by bolts passing around it, and timbers and chains along the sides, securing it in that manner to the timbers next to the trunnions. The monument was raised up into horizontal position by jack-screws and was secured by blocking until the centre was at the desired height; then, by means of rollers against the timber, it was slowly swung into the vertical position and held in that manner until the base and die were laid; then the obelisk was brought over the die and let down into its desired position. After the removal of the timber the trunnions were cut down to a surface uniform with the sides of the monument. The total cost of moving the monument through its route of 500 miles from the quarry to the river bank was $1,627, while the cost of moving it on land and erecting in its present position was about $4,400, making that portion of the original cost about $6,000; the entire cost of the whole work was covered by the contract price of $50,000. The obelisk is a monument erected to the memory of Major John E. Wool, a soldier in the Federal army during the late rebellion; before that in the Mexican war. This fitting tribute to a skilful soldier and a brave man can be seen for many miles up and down the Hudson River, rearing its peak above the trees of the Oakwood Cemetery in the outskirts of Troy. — *Engineering.*

Clay Roofing-tile. — In a recent number of the *Brick, Tile and Metal Review* we find the following account of the manufacture of roofing-tile as carried on at Akron, Ohio. Ordinary brick clay is used: "The grinding and tempering is done in tracers, such as used for sewer-pipe. When tempered, whatever is put into the cylinder is forced out at the end of the stroke in a series of parallel plates, about 6 inches wide by 3-8 inch thick, and extending along until cut up in lengths. Considerable oil is used to keep the clay smooth and to keep the freshly pressed plates from sticking. These plates are adjusted one after another, on a series of disks arranged on the circumference of a circular revolving disk. This disk moves through one-sixth of its circumference at a stroke, boring in succession each plate of clay spread out on its table under a compound piston. This piston is arranged to cut off the edge of the plate in a symmetrical shape, and then to press it into the required shape. The pressed tiles are removed and set in piles to dry. Drying takes about two weeks in a steam-heated chamber, as the oil used in the pressing of the clay hinders the escape of the water. They are finally piled in loose order in a kiln to a depth of about 6 feet, and subjected to a light burn. The kilns employed are circular down-drafts. The ware is of several classes. Shingle tile, which are more like shingles than anything else, are slabs of burnt clay 12 x 6 inches x 3-8 inch, with holes in proper places for nailing them to the roof. Their uses are as nearly like those of a real shingle as well can be. About 5 inches of each tile are exposed to the weather. The so-called 'diamond tile' are made to hook into each other, but are also supplemented by nails. They are more ornamental than the shingle tiles, but as they are more dependent on each other for support they are not so durable or strong. One of the chief objections to a tile roof is its weight; a 10-foot square of plain shingle-tile weighs about 1,100 pounds, and the same area of diamond tile weighs from 650 to 850 pounds. The advantages claimed for them are durability, beauty, and immunity from danger by fire or lightning."

An Incident of the Building of the Forth Bridge. — "In a lecture given at Dundee, Scotland, Mr. Baker, one of the Forth Bridge engineers, tells a fine story of modern heroism," says the *St. James's Gazette.* "Six men were one day working at the bridge, standing on a plank 140 feet above the sea level. One of the hooks supporting the plank gave way. With great presence of mind three of the men sprang at the steelwork of the bridge and held on; a fourth dived, was rescued, and, it may be added incidentally, almost immediately resumed work. Of the three hanging to the steelwork by the arms, two were in particular danger; yet when the rescue party reached the first of them, all he said was, 'I can hold on; go to the other man: he is dazed.' In all, thirty-five men have lost their lives during the five years the bridge has been building, and 2,300 is the average number of workmen employed at a time. Mr. Baker says that though many superior workmen were needed there was no lack of them. As for the magnitude of the undertaking, 'as a grenadier guardsman is to a new-born infant, so is the Forth Bridge to the largest bridge yet built in Great Britain.'"

TRADE SURVEYS

A few weeks ago a wide-spread apprehension existed that a general decline in values might set in which would go to the length of depressing enterprise and weakening the confidence which had existed with regard to next year's business. Within the past week or two apprehensions have arisen that we are on the eve of an advancing tendency in prices, which some fear may have the same effect of checking enterprise or creating undue conservatism. There is very little danger of either of these results. The wiser manufacturers, builders, engineers, bankers, and investors of money are all acting upon the presumption that the legitimate requirements of this country will steadily increase. It is true they keep in mind the possibility of running into extremes, as has been done in the past, but they do not lose sight of the fact that there are fewer dangers to-day of such results than ever; that trade and industry are better organized, that the intelligence of the country has a stronger grip upon business requirements and opportunities, and that the finances of the country are in better shape and less liable to fluctuations than ever before. The preference upon the part of large and small investors is still for manufacturing and industrial enterprise rather than for stock speculation and railroad building. The great bulk of the railway mileage constructed during the past year has been done by railroad companies well able to endure a year or two of poor earnings. Even with the undue parallelization of roads in the Northwest there is really less danger of rate-cutting and low earnings than many trade journals would have us believe. The Northwest is growing rapidly and the railroad management at Chicago is in better shape to maintain friendly relations than a year ago. The elements of discord which then existed do not exist now, and even if railroad building has been, as is alleged, overdone in the Northwest, there is less probability that it will be followed by a cutting of rates. Traffic is being stimulated and travel is also expanding. Trans-continental lines are being put on; stations are multiplying. Inducements to increase travel are being held out. A large amount of Eastern capital is finding employment in the Northwest and West, and a number of influences are at work which, instead of restricting railroad-building enterprise there, will increase it. In fact, within a week or so syndicates have been conferring together with a view of a still further increase in railroad mileage between Chicago and the far West. But taking a conservative view of the situation, it is safe to say that a great deal of railroad building will be done west of the Mississippi next year which is not now expected. Brokers in all Eastern cities have been instructed by their patrons to buy more stocks and bonds. The bull movement is attracting hundreds into the market. There is an abundance of money for all kinds of legitimate investment and a sufficiency to keep the brokers in heart. Prices in many lines have an upward tendency, but it is doubtful whether it is desirable that it should be maintained. For the next two or three weeks money will be more stringent. Money is in very active demand all over the West and Southwest, and it is not returning to New York as freely as lenders had anticipated. The steel-rail makers threaten to shut down some of their mills unless buyers will place their orders in a short time. There are inquiries for over 100,000 tons in the market, but the companies needing this material have been expecting to secure more favorable terms than makers have as yet been disposed to offer. The difference will be probably adjusted in a week or two. All other branches of the iron trade are active and prices are strong. An immense amount of business is being done in wrought-iron pipe for next spring and summer's natural-gas requirements. New wells are coming-in in the natural-gas region, and inquiries are pouring in from manufacturers in various parts of the country as to terms and conditions upon which new industries can be supplied with this valuable fuel. Natural gas has given a great stimulus to the production of an artificial gas of equivalent economic advantage, and it now seems probable that a dozen or more methods of artificial-gas making will be adopted by large manufacturing interests within a year. Raw fuel is rapidly going out of use, and it is encouraging to note the interest taken in it by manufacturers, great and small, not only for the economic features involved in the change, but for the general tendency to adopt a more scientific method of utilizing fuel. Late advices from Western and Southern lumber centres show that next year's supply will be unusually large. Arrivals are stated to be large at all points. These stocks are not heavy, a fact which goes to show that consumption is maintained by an extraordinary limit. The demand for lumber throughout the interior is greater this year than for many years, and if it continues it will preserve prices next year at a high point. A great many lumber interests are apprehensive of a cutting in prices next year on account of the heavy stocks which they know will be crowded into the market, but they overlook the rural demand which is assuming very large proportions. Within the past thirty days the builders of nearly all kinds of engines and machinery have added to their order-books. This is particularly true of builders of locomotives. The manufacturers of agricultural implements in the West had no failure in demand, although the increase in implement-making capacity has been such as to keep prices very low. The growth of machine-shop capacity throughout the West continues. It is caused mainly by the expansion of railroad building. Authorities state that in four cities in the Northwest over one hundred establishments have been established within the past year. A great deal of bridge work has been brought to the attention of bridge-builders and structural iron-makers within two weeks. Nearly all of the railroad companies intend to use a portion of their increased surplus to the improvement of their bridges as well as their tracks. Bridges will receive first attention. Woodwork will be supplanted by ironwork. Should the favorable earnings of railroad companies continue, bridge-builders and makers of all kinds of small railway material will have a great deal of work during the coming winter and spring. The labor question is attracting less attention than ever, and, so far as can be gleaned from the statements of leaders in both of the great wings of the workmen's labor organizations, there is no present intention of introducing disquieting questions or agitations next spring.

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CONTENTS

ONE of the acts of the recent Convention of the American Institute of Architects was to appoint a committee to consult with a similar committee of the Western Association of Architects, with a view to the consolidation of all the great architectural societies of the country in one body, perhaps under the name, now dignified by many years of reputable history, of the American Institute of Architects, but with an organization adapted to the active part in professional affairs which it is desirable that the new association should take. It would hardly be courteous to the committee to anticipate its discussions of a subject which is very well presented in the paper read before the Convention by Mr. Burnham; but we may, perhaps, be of some service in the matter at this early day, by inviting, after the manner of some of the foreign societies, suggestions for a list of things desirable for the profession, which will, at least, be interesting, and, probably, valuable to those who have to consider officially the best course to take in a new effort to promote the interest of architects and architecture in America. To give an idea of the sort of suggestions we mean, we will quote from those of the Society of Architects and Engineers of the Maritime Alps, which keeps in view, among other desirable objects, the establishment of exhibitions of architectural designs, under the auspices of the Society; the regular award, at the solicitation of the Society, of prizes by the municipal authority of large cities, for the best private buildings, as is already done by Brussels and Rouen; the award of medals and other honors by the Society to members, and to draughtsmen and students in professional schools, and, on occasion, the commemoration, by statues, mural tablets, or other monuments, of great architects and artists. For this country, it would be natural to add the wish that a successful effort might be made to raise the character of the design of public buildings, and many more ideas of the sort, will, undoubtedly, occur to our readers, which we hope they will communicate to us.

A CASE was recently tried in New York, which has a decided interest for builders as well as owners. Some time ago the owner of a hotel on Sixth Avenue decided to have certain alterations made in his building, and had plans and specifications prepared, and estimates invited. The lowest offer for the work was four thousand two hundred and thirteen dollars, and the architect was instructed to draw up a contract with this bidder on the basis of his estimate. He deputed the duty of writing the contract to an assistant, who composed it in proper form. When, however, he came to filling in the amount of the consideration, he asked a fellow-draughtsman what the original bid was, and the other, by a mental slip of a very common kind, told him that it was fifty-two hundred and thirteen dollars. The contract was accordingly completed, with this as the consideration, instead of the real amount of the bid, which was a thousand dollars less. Soon after, the hotel proprietor came into the office to sign the contract; and, asking the managing assistant if it was all right, he signed it, as hundreds of easy-going persons do, without reading it. He then instructed his son, who kept his books, to pay the contractor from time to time on account, and left him a number of checks, signed in blank, for the purpose. After the work was finished, the contractor rendered a bill for the contract and extras, in which the first item was a charge of fifty-two hundred and thirteen dollars, as the contract price. The architect, after comparing the work with the specifications, and finding that everything had been done as agreed, approved the bill, without noticing the discrepancy between the contract price, as charged, and the original bid; and the hotel-proprietor's son, on presentation of the bill, certified by the architect, paid it with the blank checks left in his hands, and brought the receipt to his father. The latter, who very naturally remembered the circumstances of the bidding better than any one else, immediately perceived that a mistake had been made, and, after learning the facts, made a demand upon the contractor for the return of the thousand dollars overpaid him. The contractor refused to pay it back, on the ground that he had made a mistake of a thousand dollars in his bid, and that the contract only rectified his own mistake. The case was brought before the Court of Common Pleas, and the Court, after hearing the story, ordered that the contract should be reformed to correspond with the bid, and that the contractor should pay back the thousand dollars which he had obtained by mistake.

IT may well be doubted whether Mr. Henry G. Marquand's house in New York will not be, when finished and furnished, the most beautiful residence in the world. Of course, there are many royal palaces larger, and some bits of royal furniture more costly, than anything that Mr. Marquand has, but our experience has not served to attract us to palaces as works of art, while the furniture in most of them that we have seen would not do much credit, in point of design, to a country hotel. Mr. Marquand is one of the few people who like to have all the things about them as beautiful, in their way, as they can possibly be, and he has, what still fewer persons possess, both the appreciation of what is beautiful and the courage to get it, without troubling himself about whether it is fashionable, or what other people will say of it. A year ago, one of his rooms was decorated with the unrivalled, we might well say immortal, painting made for it by Sir Frederick Leighton, who, notwithstanding Mr. Whistler's cheap sarcasms, is as thorough an artist as any man in England. Since then, he has added to it various pieces of furniture, the most famous of which is the piano, designed by Alma-Tadema, and carried out with the coöperation of several distinguished artists. The case of this instrument, imperfect descriptions of which have appeared in many of the daily papers, is of ebony, showing the brownish streaks which brighten the natural wood. The legs are enriched with carvings in oak, set into the ebony, and the upper portion of the case is inlaid with flat ornaments in various materials and decorated with mouldings in ivory, boxwood and cedar. The principal flat ornament on the side consists of a band, which runs all around the case, and shows a Greek pattern in ebony on a background of ivory, with small rosette ornaments in the pattern, the centres of which are alternately of coral and pearl; and at each corner of the case is an interlaced inlaid ornament of ivory, cedar, boxwood and pearl. Around the top of the case is another inlaid band of ivory on a cedar ground, with spots of pearl, ebony and boxwood, and within the band are inlaid wreaths tied with ribbons, the ends of which are little balls of pearl and coral, while the names of the Muses, in pearl letters, with narrow ivory borders, occupy the interior of the wreaths. The music-rest is of wrought silver, copper and brass, and panels of repoussé silver finish the ends. The instrument is insured for forty thousand dollars, and probably cost considerably more, and is accompanied by chairs for which Mr. Marquand is said to have paid seventy-five hundred dollars apiece in London. Although these seem enormous prices for furniture, it is by no means certain that the money which they cost was not well invested, merely from a financial point of view. It is not long since about seventy thousand dollars was paid at auction for two bits of Riesener furniture, beautiful in their way, but much less interesting and artistic than the Marquand piano. Riesener's work was costly enough when

new, one of the Hamilton pieces having cost, it is said, sixteen thousand dollars to make, but the fact that it has more than doubled in value in a hundred years shows that its artistic merit has been more and more appreciated, while ordinary *boule* furniture has been consigned to the rubbish-heap, and the Marquand treasures, so long as there are people with money enough to buy them, are likely to become more and more desirable as pieces of property.

MR. IRA O. BAKER, a member of the Western Society of Civil Engineers, recently read before the Society an interesting paper on the formulas for the bearing power of piles, which is published in the *Journal* of the Association of Engineering Societies. It is hardly necessary to say that the calculation of the resistance of piles is one of the most unsatisfactory and uncertain processes which architects and engineers have to use. Of course, there are plenty of formulas, some practical and some theoretical, but these have, as a rule, been constructed to suit different special cases, and give widely divergent results when several are applied to the same example. For instance, Mr. Baker quotes an article which gives four formulas. These formulas, applied to a given case, give results so widely divergent that the largest is seventeen hundred and seventy-one times as great as the smallest. It is absurd to consider such rules as having any scientific value, and, as Mr. Baker well says, it is not creditable to the profession of engineering, or, he might have added, to that of architecture, that our knowledge of such an important subject should be in so hazy a state. We suppose that Sanders's well-known formula is that most commonly used in calculating the resistance of piles in filled land, myriads of which are driven every year in our seaport and lake cities, and experience seems to show that with hammers of about a ton weight, and a sinking at the last blow of two, three, four or five inches, its results are tolerably accurate indications of the maximum safe resistance of the pile, but under other conditions it is nearly valueless. Mr. Baker gives a striking comparison of the actual results obtained by testing a pile with those derived from the formulæ of various authors. The pile was driven with a hammer weighing nine hundred and ten pounds, falling five feet, and sank three-eighths of an inch at the last blow. By Sanders's formula, it should have been capable of supporting safely a load of eighteen thousand two hundred pounds; by Rankine's, of one hundred and twenty-eight thousand; by Haswell's, of seventy-two thousand; by Nystrom's, of nine thousand, and by Weisbach's, of one hundred and eleven thousand. On loading, it was found to bear fifty-nine thousand six hundred and eighteen pounds without moving, but sank very slowly on the addition of less than three thousand pounds. What should be the factor of safety in such cases it is impossible to say, and Sanders's, which would be about three, might not be excessive. Mr. Baker himself gives the formula, derived from analysis, $P = \sqrt{2qWh + q^2d^2} - qd$, in which W is the weight of the hammer, h the height from which it falls, in feet, d is the sinking at the last blow, also in feet, and q is a coëfficient to be determined by experiment, but which in many cases is about six thousand. Of course, this is only suggested as an attempt to "contract a little the limits of the unknown and uncertain," but it is at least interesting. One observation which Mr. Baker makes is of much importance. The record of driving piles in various places shows that a great difference in the effect of the impact of the hammer results from the "brooming" of the head of the pile. In one case, after the head of a pile which had become badly broomed was adzed off, the efficiency of the succeeding blows was nearly four times as great as before the adzing, and this should form a very important factor in determining constants for practice.

DR. SCHLEIMANN has undertaken a new work, this time on what might seem rather barren ground. He has obtained a concession from the Greek Government to excavate in the island of Cerigo, the ancient Cythera, off the Poloponnesian coast, where are still visible the remains of a temple of Venus. The antique traditions represent that Venus rose from the sea near this island, and the temple dedicated to her here was the oldest and most sacred in Greece, so that its remains would have a certain interest on this account, but they are likely to have also an ethnological and historical value from the fact that Cythera was one of the earliest colonies of the Phœnicians, and as the temple to the beautiful goddess is said to have been founded by them, the explorations can hardly fail to bring to light something bearing upon the curious problem of Phœnician influence in Greece. To the ordinary mind the results will, however, probably be far less interesting than those which may be hoped for from the excavations which are to be made by the Italian Government at Sybaris. As Cythera has been fought over, captured and sacked by nearly every Mediterranean State in succession, there can hardly be much left in the little island but property which the most inveterate plunderers did not think worth carrying away, while Sybaris, after its capture, was covered with alluvium from the river, turned from its course for the purpose, and has since slept undisturbed under this effective blanket. Moreover, while Cythera, aside from the temple, was never anything but a small town, Sybaris was a great city, at least as rich, and perhaps as populous, as Chicago or St. Louis.

L'EMULATION, the handsome publication of the Société Centrale d'Architecture de Belgique, describes a method of sinking wells, which, if not altogether new, presents advantages which are worth keeping in mind. Every one remembers the ancient device mentioned in the text-books, of making a ring of planks, building a circular wall of brick on it, and excavating under it, so as to let it descend slowly, a mason stationed on the surface continuing to build at the top of the shaft as the lower end descended into the earth. This system had the inconvenience that if the excavator in the pit happened to handle his shovel unskilfully, or to strike a vein of sand on one side of the hole, so as to let the wooden ring deviate from a horizontal position, he was liable to have the brickwork fall on his head, and it never became very popular, but the improved method, while presenting all the advantages of the old one, is free from its worst defects. Instead of a wooden ring, with a brick wall on top of it, a short ring of concrete, resembling the cement sewer-pipes once so much used, is set upright on the ground. The well-digger gets into it and digs under it, so as to let it sink vertically into the ground. Unlike the sewer-pipes, the socket, by which the joint is made with the next length, is made on the inside of the well-pipe, and forms a projecting interior ring, while the outside is smooth. The joint is formed with cement in the usual way, and the laborer, continuing to excavate at the bottom, soon makes room for the second length to descend, and so on, until the desired depth is reached. A concrete dome, with a man-hole in the middle, is then set on the top, and the well is done. No mortar is used in setting the dome, so that it may be removed, if necessary, and the well deepened by the same process as before. All the other joints are made tight with cement, and the well is perfectly secure against the entrance of surface-water, while it has the additional advantage of being cheap, easily extended to any depth, and perfectly safe for those who do the excavation, in any soil, however treacherous. In places where shafts of this sort could be made, we should generally employ driven wells, which would be cheaper still, but these do not always furnish water fast enough for use, and contain no reserve supply, so that we have known wells sunk in just the way described, except that cement drain-pipes were used, instead of the special shapes, with the sockets on the inside, which are not only smoother, but afford, by means of their interior rings, a convenient foothold for descending into the well without using ladders or ropes.

THE Swiss archæological journal *Antiqua* gives the information that several manufacturers of spurious antiquities have recently been established in the Alpine valleys. In the little town of Concise, on the Lake of Neufchâtel, is a flourishing establishment for the production of relics of the lake-dwellers, who, in pre-historic times, lived in huts built on piles over the waters of most of the Swiss lakes. Near Schaffhausen is said to be another factory, where bones are engraved with outline representations of reindeer, bears, foxes and so on, and sold as genuine relics of the cave-dwellers, who really scratched such images on bones many thousand years ago, when the reindeer inhabited the south of Europe. In still another place near the lake of Neufchâtel is a factory of relics of the stone and bronze ages, consisting of stone bracelets, bone bits for horses, bronze knives and ornaments, and other objects, which are, when finished, sent to the bric-à-brac shops at Berne and elsewhere for sale. This interesting industry is not at all approved of by the Swiss men of science, and it is to be hoped that some means will be found for putting a stop to it.

LANDSCAPE GARDENING.[1] — II.



IN a former chapter I tried to show that the intending landscape-gardener should train his eye and judgment and cultivate his taste by studying not only the works of nature but the works of artists in other branches and the broadest, deepest principles of art in general. This, however, is but the sort of study he should pursue when he is *not* studying. His real hours of work will be filled by tasks of a more prosaic kind.

It is almost superfluous to say that he must make a thoroughly scientific study of those natural elements with which he will have to deal. A knowledge of soils and exposures and climatic peculiarities, of methods of draining land, improving surfaces, building roads, managing water, transplanting trees — this is the practical foundation upon which his art must rest. Of course, too, if he would well express his ideas he must have a large vocabulary at command — if he would do the best possible thing under given circumstances, he must have the widest possible knowledge of the resources which Nature's infinite fertility supplies. It will not suffice that he shall pile his table with catalogues of trees and shrubs and flowers, or even that he shall have a broad superficial acquaintance with their aspect. He must know them all in the sense of knowing how they grow and what they need, where they will flourish and where fail, how long they will last and how they will look at various seasons of the year. He must know plants, in short, not exactly as the scientific botanist knows them, but as the practical cultivator does. If the more artistic side of his intelligence has been properly developed, there should be no danger of his falling into the cultivator's mistake of prizing individual specimens more than general effects, or thinking that when things are attractive one cannot have too many of them. Like a good painter, he will prize his general effect above everything else, yet will remember that it depends upon details, each of which is of great though subordinated importance. Indeed, he will know that his details are of much more importance than the painter's, inasmuch as his public cannot be kept at a given point of view. If he slurs details in the attempt to "generalize" in painter fashion, a few steps' advance will change his charming middle-distance into an ugly, inartistic foreground.

To learn how to drain lands and build roads implies a certain amount of education in the practice of engineering, and this should infallibly be supplemented by a certain amount of acquaintance with the principles of architecture. Almost always the landscape-gardener's and the architect's work must unite to form a single whole. Now, the landscape-gardener must ask the architect to furnish features to complete his own design — as the bridges, balustrades and shelters for a great public park. Again, he will be obliged to adapt his own work to the architect's design — as when grounds are to be laid out in the immediate neighborhood of some public or private structure. Rarely, if ever, will he be able to leave architectural elements entirely out of consideration, and, therefore, the better he understands not only the general principles and ideals of the art, but also the characteristics of its several styles, the more sure he will be of acting in harmony with the architect and of making a success of his own part of their common result.

Architectural training will also help him in another and most important direction. To learn how to plan well means that he must learn not only how to make charming pictures, but how to accommodate the people who are to enjoy them. This task is comparatively simple when small grounds are in question, but it is extremely complicated and difficult in the case, for example, of such a domain as the Central Park. To fit such a place as this for popular use, to make it at once beautiful and convenient, to preserve its landscape aspect and yet open up all its parts to vast troops of people — giving them ample accommodations for walking, driving, riding, playing, and assembling together, and insuring them safety as well as comfort — this is a task which needs for its perfect accomplishment the highest degree of creative imagination, at once practical and æsthetic in character. It is a more difficult task than the planning of the most complex structure that ever was built, yet one in which early practice in the planning of structures should be of great assistance.

In the book to which I referred in my previous chapter, Mr. Scott insists upon the necessity for preparing paper plans even when the smallest garden is to be laid out, and every other writer upon the art preaches in the same strain. The necessity for such plans is generally recognized with regard to large problems, but few clients recognize it with regard to small ones, and, I fear, not all of those who, with more or less right, call themselves professional artists. It should, however, be recognized by every student as absolutely indispensable with every class of work; and there is no exercise which will better reveal the difficulties before him and give insight into the ways in which they may be met than constant practice with imaginary problems on paper. In actual work a sight of the chosen spot will, of course, suggest to the imagination the best general scheme of treatment, and cannot possibly be dispensed with. But the scheme thus conceived cannot be tested and developed in imagination any more than an architect's first idea of a building. It is needful, however, for the student to remember that though paper is infinitely useful, it cannot be implicitly trusted with regard to grounds any more than with regard to buildings. Neither in the one case nor in the other does a pretty drawing mean the surety of a good piece of work. Practical experience must be added to closest study before true insight can be gained into the true essentials of success. Mr. Scott, by the way, instructively points out the dangers into which a planner may fall by not taking into account those laws of perspective which may cause a thing that seems good on paper to look very different in execution.

Where now, it may be asked, is this complex art of landscape-gardening taught? Unfortunately, the answer must be, Nowhere, except in the offices of the very few men who practise it on a large scale with success. The preliminary training in engineering, architecture and agriculture may, of course, be gained in various well-known schools; it is not difficult to get botanical instruction; Nature is always ready to be looked at and willing to yield up her secrets to the sympathetic eye; and an understanding of art in general and of painters' ideals and methods may be cultivated in any place where galleries and libraries are open. But there are very few botanical instructors who can explain the artistic value as well as the scientific characteristics of plants, great and small; and the landscape-gardener's art as an art — as a whole or in any of its aspects — is nowhere publicly taught. I believe there is no school for it even in Paris, where there are schools for everything else that is artistic or semi-artistic in character. In various government establishments various kinds of plants are grown in the most scientific way, and professors are employed to teach the method of their cultivation to classes of pupils on the ground. Such instruction is invaluable, of course, to those who mean to be practical cultivators, but it can help the artist only in so far as it helps him to lay the foundation upon which his art as such must rest. I imagine that the only place where the art as such can be studied is in Japan, or, perhaps, China. In Japan, I am told, there is as yet no actual school, but practised professors of the art exist, and, lest their race perish amid the new confusion into which the empire has been thrown, a government school is soon to be established. But Japan is rather too far away to attract the student of landscape-art as Paris attracts the student of architecture.

European travel, of course, will profit him much not only by enlarging his knowledge of his materials, but by showing him how his predecessors have worked. Yet, in this latter way it will hardly be so profitable as the reader may think. The great days of the art closed many years ago. There is no one now alive in England, for instance, who practises it as the great masters of the last century did. The gardener has largely taken the place of the landscape-gardener, and very many of the works the great masters left have perished. A painter's work remains intact as long as canvas and pigment hold together. But a landscape-gardener's contains within itself the seeds of rapid change, and must be perpetually and sympathetically retouched if it is to remain even the semblance of itself. Neglect has wrought havoc with countless beautiful English places; change in the conditions of local life has obliterated others; and increasing bad taste has made the retouching which has taken place a further source of injury. On the Continent the same energies of destruction have been at work. Here and there one still finds fine old parks and places in a fairly good stage of preservation, and they are numerous enough to make a European tour almost indispensable, more especially because they afford a sight of certain kinds of excellence which can hardly be said to exist in our own country. Here at home we may learn from nature how to design scenes which shall be thoroughly rural in character; but how to design scenes which must be semi-formal in order to harmonize with beautiful works of architecture, may best be learned from that which survives of the art of the past in Italy, France, Germany and England.

As to modern work abroad, some of it is good and a little is very good, but most of it is bad. The practice of the art has again changed for the better — on the Continent at least — within very recent times, and we may perhaps look to see it in process of fertile and right development in the coming years. But to-day even when work is good in general scheme — and this is by no means always — it is constantly marred by the same bad taste in matters of detail which so often shocks us at home. When we find our own clients and some of our own artists confusing the significance of the words, *landscape, park, garden,* and trying to cram into one result the beauties proper to each kind of scheme; or when we find tropical plants intruding themselves, without thought of harmony and fitness, into sylvan corners which should have a thoroughly native, natural air; or when we shudder at the chromo vulgarity of our coleus-beds, and red and pink geranium borders; or when we see pretty things huddled together into ugly masses or ugly things flaunting themselves freely, sure of admiration because they are novelties — we may, at least,

[1] Continued from page 159, No. 614.

feel sure that over the water we should find just the same mistakes, and just as many of them.

Travel on this side of the water is even more indispensable than travel abroad. Nature speaks to us more variously and naturally in America than in Europe, and our own results in the art of dealing with her materials are in general the most instructive as being the outcome of the special conditions with which the American student will have to deal. Some of our problems are analogous to those of foreign lands, but many of them are individual to ourselves. Most of our country houses are differently built, placed and surrounded from those of other countries. Our cities are differently planned. Our large parks are often laid out upon virgin soil, instead of upon sites which have already been used for other purposes. Our cemeteries are important and unique conceptions. And our villages are, in general idea and arrangement, like none in the Old World. If we add to these differences those fundamental diversities in soil, climate and atmospheric effect which must always be taken into account, it will, at least, be clear that the first travelling a student does should be in his own country. Only when he knows what is wanted here and what can well be achieved here, will he be fitted to gather useful hints abroad.

He will find many deplorable things along his course. But "shocking examples" are very useful object-lessons if analyzed for their reasons why, and with them he will also find many delightful and inspiring things — more perhaps than he will anticipate, and more, in certain directions, than he will find abroad. If we have had few professed landscape-gardeners, we have had one or two of exceptional ability; and the untutored instinct of the people has sometimes worked with singular felicity — as in the arrangement of the villages of New England.

The best preparation for a home tour would be the perusal of a book written in 1879, by M. Edouard André, and called "*L'Art des Jardins*." The author is the foremost of living French landscape-gardeners, and has travelled widely both in this country and in Europe. His book supplies not only clear ideas with regard to the work a landscape-gardener must do, and the spirit and ways in which he must do it, and an interesting outline-history of the art, but also descriptive analyses of modern work in various lands. And it should be especially profitable to the American student as helping him to realize how well Americans have already done in his profession. In spite of that "spread-eagle" spirit which is so often attributed to us, we still hestiate to think that we have really done anything very good in any kind of art until foreign critics have told us so. Or, perhaps, I should say, we are still unable to see that we have until foreign critics point out the fact. M. André points it out with regard to our landscape-gardening work with a quality of praise which is cheering, indeed. He praises that arrangement of our villages and of some of our summer-colonies, which allows the individual beauty of each place to play its part in producing a broader general beauty — noting especially the generous and brotherly spirit which has so laid out the Newport cliffs that one house interferes as little as possible with the outlook of the others, and that the public is allowed a right of way along the brink. He speaks with enthusiasm of the schemes adopted for our cemeteries — schemes for which no precedents were found in Europe, but which, he thinks, might well be imitated there. He lauds the wise foresight which has caused the laying-out of great public parks at that early stage of civic life before land has become prohibitively dear — sometimes even before the city itself deserves the name. And he explains with particular praise the skill with which Mr. Frederick Law Olmsted — sometimes alone and sometimes assisted by Mr. Calvin Vaux — has created such parks. There is no living European artist whom he praises so greatly. There is none in whom he recognizes so high a degree of that power which is the most essential to success with large problems — the power to design broad and beautiful landscape pictures, and at the same time comfortably accommodate vast concourses of people.

In truth, there is nothing in all the world which may more profitably be studied for the fundamental quality of *good planning* than these parks of Mr. Olmsted's. When a student has arrived at the point of really appreciating all their excellence, and really understanding the ideals and the methods by which it has been arrived at, he may feel sure he has done much to fit himself for the practice of his art in whatever direction he may be called upon to work. Small problems are not very instructive with regard to the management of large ones; but the way in which a large problem has been managed — as a whole, and in its several parts — may be infinitely instructive with regard to the smallest. That is to say if the student always bear in mind that in this, as in every art the prime virtue of all virtues, is *appropriateness*.

Of all our parks the Central Park is the most interesting and instructive. Others are more beautiful — Prospect Park in Brooklyn, for instance, which is also one of Mr. Olmsted's, and perhaps, in intrinsic charm of result, the best of all. But it is more beautiful than the Central Park, because the site was more advantageous; and for this same reason it is less instructive. No task more difficult than that of making a park in the centre of Manhattan Island can ever be suggested to any landscape-gardener; and, therefore, when the student sees how successfully it has been mastered, he will learn the great lesson, *Never despair*. Moreover, while the broken, complicated nature of the ground gave less chance for those wide and majestic effects which so delight us in Prospect Park it was extremely favorable (given an extremely able designer) to the production of varied beauty in details. This park, therefore, affords a singularly good chance, not only to see how broad beauty may be created under seemingly impossible conditions, but also to study those smaller beauties which alone the landscape-gardener can attempt in very many of his problems. It is unusually rich also in architectural features, which, although sometimes not happy in detail, are almost invariably very excellent in general spirit and design.

Of course, no amount of looking at results like these, and studying backwards the processes through which they were arrived at, will train the student as would a course of subordinate effort upon similar schemes when actually under way. Such a course depends upon the chance of gaining admittance into an office like Mr. Olmsted's. If this chance offers, no desire for study of other sorts or for travel, and certainly no hasty wish to earn a living prematurely, should be allowed to interfere with it. It is the most precious opportunity which could come to a seriously-minded student.

M. G. van Rensselaer.

[To be continued.]

SAFE BUILDING.—XX.[1]

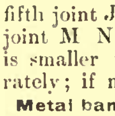


Fig. 115.

Thrust of dome. As regards abutments, there usually are none in a dome; it becomes necessary, therefore, to take up the horizontal thrust, either by metal bands around the entire dome, or by dovetailing the joints of each horizontal course. We must, of course, take the horizontal thrust existing at each joint. Thus, if we were considering the second joint H I the horizontal thrust would be $g_2\ h_2$; or, if we were considering the fifth joint J L the horizontal thrust would be $g_5\ h_5$. For the lower joint M N we might take its own horizontal thrust $g_6\ h_6$, which is smaller than $g_5\ h_5$, provided we take care of the joint J L separately; if not, we should take the larger thrust.

Metal bands. If we use a metal band its area manifestly should be strong enough to resist *one-half* the thrust, as there will be a section in tension at each end of the semi-circle, or

$$a = \frac{h}{2.\left(\frac{t}{f}\right)} \qquad (65)$$

Where a = area, in square inches, of metal bands around domes, at any joint.

Where h = the horizontal thrust at joint, in pounds.

Where $\left(\frac{t}{f}\right)$ = the safe resistance of the metal to tension, per square inch.

In our case, then, for the two lower joints, if the bands are wrought-iron, we should have, as h = 80 tons = 160000 pounds.

$$a = \frac{160000}{2.\ 12000} = 6\tfrac{2}{3}$$

Or we would use a band, say, 5″ x 1⅓″.

Strength of dowels. If dovetailed dowels of stone are used, as shown in Fig. 115, there should be one, of course, in every vertical joint. The dowels should be large enough not to tear apart at A D, nor to shear off at A E, nor to crush A B. Similarly, care

[1] Continued from page 217, No. 619.

Glossary of Symbols.—The following letters, *in all cases*, will be found to express the same meaning, *unless distinctly otherwise stated*, viz.:—
a = *area*, in square inches.
b = *breadth*, in inches.
c = constant for *ultimate resistance to compression*, in pounds, per square inch.
d = *depth*, in inches.
e = constant for *modulus of elasticity*, in pounds-inch, that is, pounds per square inch.
f = *factor-of-safety*.
g = constant for *ultimate resistance to shearing*, per square inch, across the grain.
g_{I} = constant for *ultimate resistance to shearing*, per square inch, lengthwise of the grain.
h = *height*, in inches.
i = *moment of inertia*, in inches. [See Table I.]
k = *ultimate modulus of rupture*, in pounds, per square inch.
l = *length*, in inches.
m = *moment or bending moment*, in pounds-inch.
n = *constant* in Rankine's formula for compression of long pillars. [See Table I.]
o = the *centre*.
p = the *amount* of the *left-hand re-action* (or support) of beams, in pounds.
q = the *amount* of the *right-hand re-action* (or support) of beams, in pounds.
r = *moment of resistance*, in inches. [See Table I.]
s = *strain*, in pounds.
t = constant for *ultimate resistance to tension*, in pounds, per square inch.
u = *uniform load*, in pounds.
v = *stress*, in pounds.
w = *load at centre*, in pounds.
x, y and z signify *unknown quantities*, either in pounds or inches.
δ = *total deflection*, in inches.
ρ^2 = *square of the radius of gyration*, in inches. [See Table I.]
𝔡 = *diameter*, in inches.
𝔯 = *radius*, in inches.
π = 3.14159, or, say, 3 1-7 signifies the *ratio of the circumference and diameter of a circle*.
If there are more than one of each kind, the second, third, etc., are indicated with the Roman numerals, as, for instance, a, a_{I}, a_{II}, a_{III}, etc., or b, b_{I}, b_{II}, b_{III}, etc.
In taking moments, or bending moments, strains, stresses, etc., to signify at what point they are taken, the letter signifying that point is added, as, for instance:—
m = moment or bending moment at *centre*.
m_A = " " " *point A*.
m_B = " " " *point B*.
m_X = " " " *point X*.
s = strain at *centre*.
s_B = " *point B*.
s_X = " *point X*.
v = stress at *centre*.
v_D = " *point D*.
v_X = " *point X*.
w = load at *centre*.
w_A = " *point A*.

should be taken that the area of C G + B F is sufficient to resist the tension, and of H C to resist the shearing.

The strain on A D will, of course, be tension and equal to one-half the horizontal thrust; the same formula holds good, therefore, as for metal bands, except, of course, that we use for $\left(\frac{t}{f}\right)$ its value for whatever stone we select. Supposing the dome to be built of average marble, we should have from Table V,

$$\left(\frac{t}{f}\right) = 70, \text{ therefore,}$$

$$a = \frac{160000}{2.\ 70} = 1143$$

Now if the dome is built in courses 2′ 6″ or 30″ high, the width of dovetail at its neck A D would need to be:

$$A\,D = \frac{1143}{30} = 38 \text{ inches.}$$

As this would evidently not leave sufficient area at G C and B F we must make A D smaller, and shall be compelled to use either a metal dowel, or some stronger stone. By reference to Table V we find that for bluestone,

$$\left(\frac{t}{f}\right) = 140, \text{ therefore:}$$

$$a = \frac{160000}{2.\ 140} = 571 \text{ and,}$$

$$A\,D = \frac{571}{30} = 19 \text{ inches.}$$

This would almost do for the lower joint, which is 60″ wide, for if we made: G C + B F = 38″ and
A D = 19″ it would leave
60 — 38 + 19 = 3″ or, say, 1½″ splay; that is, D H = 1½″. Had we used iron, or even slate, however, there would be no trouble.

The shearing strain on either A E or H C will, of course, be equal to one-quarter of the horizontal thrust or

$$b = \frac{h}{4.\ d.\left(\frac{g}{f}\right)} \qquad (66)$$

Where b = the width of one-half the dowel, in inches (A E)
Where h = the horizontal thrust at the joint, in pounds
Where d = the height of the course, in inches.
Where $\left(\frac{g}{f}\right)$ = the safe resistance to shearing, per square inch, of either dowel or stone voussoir (whichever is weaker).

When the shearing stress of a stone is not known, we can take the tension instead. Thus in our case as the marble is the weaker, we should use $\left(\frac{g}{f}\right) = 70$, therefore

$$A\,E = H\,C = \frac{160000}{4.\ 30.\ 70} = 19 \text{ inches.}$$

The compression on A B need not be figured, of course, for while the strain is the same as on A E, the area of A B is somewhat larger, and all stones resist compression better than shearing.

Cambered plank arch. When a plank is "cambered," sprung up, and the ends securely confined, it becomes much stronger transversely than when lying flat. The reason is very simple, as it now acts as an arch, and forces the abutments to do part of its work. Such a plank can be calculated the same as any other arch.

Spanish tile arches. Quite a curiosity in construction, somewhat in the above line, has been recently introduced in New York by a Spanish architect. He builds floor-arches but 3″ thick, of 3 successive layers of 1″-thick tiles, up to 20′ span, and more. His arches have withstood safely test-loads of 700 pounds a square foot. The secret of the strength of his arches consists in their following closely the curve of pressure, thus avoiding tension in the voussoirs, as far as possible. But even were this to exist, it could not open a joint without bodily tearing off several tiles and opening many joints, as shown in Fig. 116, owing to the fact that each course is thoroughly bonded and breaks joints with the course below; besides this, each upper layer is attached to its lower layer by Portland-cement mortar. Specimens of these tiles have been tested for the writer and were found to be as follows:

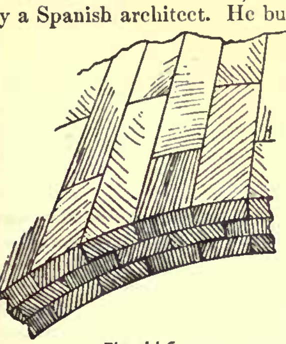


Fig. 116,

Compression (12 days old) c = 2911 pounds

$$\text{or say } \left(\frac{c}{f}\right) = 300 \text{ pounds.}$$

Tension (10 days old) t = 287 pounds

$$\text{or say } \left(\frac{t}{f}\right) = 30 \text{ pounds.}$$

The shearing stress of the mortar-joints is evidently greater than the tension, as samples tested tore across the tile and could not be sheared off.

The modulus of rupture (about 10 days old) was

$$k = 91 \text{ pounds}$$

$$\text{or, say, } \left(\frac{k}{f}\right) = 10 \text{ pounds.}$$

Of course older specimens would prove much stronger.

There is only one valid objection that the writer has heard so far against these arches, and this is, that in case of any uneven settlement they might prove dangerous; as, of course, the margin in which the curve of pressure can safely shift in case of changed surroundings is very small. The writer does not think the objection very great, however, as settlements are apt to ruin any arch and should be carefully provided against in every case. The arches have some very great advantages. The principal one, of course, is their lightness of construction and saving of weight on the floors, walls and foundations. Then, too, in most cases iron beams can be entirely dispensed with, the arches resting directly on the brick walls; of course, there must be weight enough on the wall to resist the horizontal thrust, or else iron tie-rods must be resorted to. The former is calculated as already explained for retaining walls. If tie-rods are used, they are calculated as explained above for the example of the 7″ flat floor arch. An example of these 3″-tile arches may be of interest.

Example IX.

A segmental 3″ tile arch, built as explained above, has 20′ clear span with a rise at the centre of 20″. The floor is loaded at the rate of 150 *pounds per square foot. Is the arch safe?*

Example of tile arch. We divide the arch into five parts or voussoirs, each voussoir carrying 2′ of floor = 300 pounds; we make (Fig. 118) ab = 300 pounds, bc = 300 pounds, etc., and find

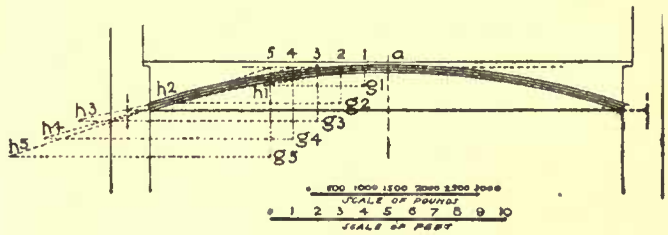


Fig 117.

the horizontal pressures (Fig. 117) $g_1\,h_1$, $g_2\,h_2$, etc. The last one $g_5\,h_5$ is the largest and scales 4500 units or pounds. We now make (Fig. 118) $a\,o = g_5\,h_5$ = 4500 pounds and draw ob, oc, od, etc. We next construct the curve of pressure $a\,K$ and find that it coincides as closely as possible with the centre line of the arch. This means that

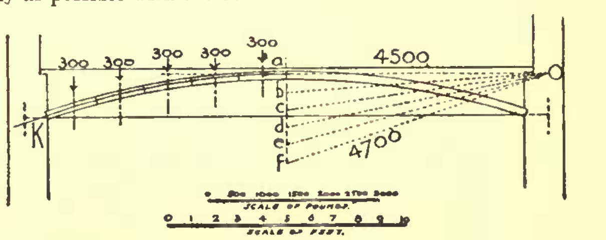


Fig. 118.

the pressure on each joint will be uniformly distributed. That on the lower joint is, of course, the largest and is = $o\,f$, which scales 4700 pounds. The area of the joint is, of course, a = 3. 12 = 36 square inches, therefore the greatest stress per square inch will be

$$\frac{4700}{36} = 130 \text{ pounds compression.}$$

As the tests gave us 300 pounds compression, per square inch, as safe stress of a sample only twelve days old, the arch is, of course, perfectly safe.

If, however, instead of a uniform load, we had to provide for a very heavy concentrated load, or heavy-moving loads, or vibrations, it would not be advisable to use these arches.

Danger of sliding. So far we have simply considered the danger of compression or tension at the joints of an arch; there is, however, another element of danger, though one that does not arise frequently, viz.: the danger of one voussoir sliding past the other. Where strong and quick-setting cements are used this danger is, of course, not very great. But in other cases, and particularly in large arches, it must be guarded against. The angle of friction of brick against brick (or stone against stone) being generally assumed at 30°, care must be taken that the angle formed by the curve of pressure at the joint, with a normal to the joint (at the point of intersection K) does not form an angle greater than 30°. If the angle be greater than 30° there is danger of sliding; if smaller, there is, of course, no danger. Thus, if in Fig. 114 we erect through K_4 a normal $K_4\,X$ to the joint, the angle $X\,K_4\,i_3$ should not exceed 30°.

Danger of shearing In arches with heavy-concentrated loads at single points, there might, in rare cases, be danger of the load shearing right through the arch. The resistance to shearing

would, of course, be directly as the vertical area of cross-section of the arch, and in such cases this area must be made large enough to resist any tendency to shear.

Depth at crown. Arches are frequently built shallower at the crown and increasing gradually in depth towards the spring, the amount being regulated, of course, by the curve of pressure and Formulæ (44) and (45).

To establish the first experimental thickness at the crown of an arch, many engineers use the empyrical formula.

$$x = y.\sqrt{r} \qquad (67)$$

Where x = the depth of arch, at crown, in inches.
Where r = the radius at crown, in inches.
Where y = a constant, as follows:
For cut stone, in blocks: $y = 0{,}3$
For brickwork $y = 0{,}4$
For rubblework $y = 0{,}45$

When Portland cement is used, a somewhat lower value may be assumed for y. The depth thus established for crown is only expermental, of course, and must be varied by calculation of curve of pressure, etc.

Approximate rule. In cases where the architect does not feel the necessity for such a close calculation of the arch, it will be sufficient to find the curve of pressure. If this curve of pressure comes *within* the inner third of arch-ring, at every point, the arch is safe, provided the thrust on each joint, divided by the area of joint, does not exceed *one-half* of the safe compressive stress of the material, or:

$$\frac{p}{a} = \frac{1}{2}.\left(\frac{c}{f}\right)$$

Where p = the thrust on joint, in pounds.
Where a = the area of joint, in square inches.
Where $\left(\frac{c}{f}\right)$ = the safe resistance to compression, per square inch, of the material.

Louis DeCoppet Berg.

[To be continued.]

ILLUSTRATIONS

[*Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.*]

BEAUPORT, P. Q.

[Helio-chrome, issued only with Imperial Edition.]

COTTAGE FOR E. W. DEWEY, ESQ., FRIENDLY ISLAND, ALEXANDER BAY, CANADA. MR. W. S. KNOWLES, ARCHITECT, NEW YORK, N. Y.

HOUSE OF S. A. BROWN, ESQ., CHICAGO, ILL. MESSRS. BURLING & WHITEHOUSE, ARCHITECTS, CHICAGO, ILL.

The material of which this house is built is Bedford, Ind., stone, and hardwoods are used for the inside finish.

HOUSE OF J. J. MASTIN, ESQ., KANSAS CITY, MO. MESSRS. VAN BRUNT & HOWE, ARCHITECTS, KANSAS CITY, MO.

Owing to an error in the make-up this drawing was mentioned as amongst the illustrations of our issue for Nov. 26.

BUILDING FOR THE WELLS AND FARGO EXPRESS CO., OWNED BY F. SHARON, ESQ., SAN FRANCISCO, CAL. MESSRS. SHEPLEY, RUTAN & COOLIDGE, ARCHITECTS, BROOKLINE, MASS.

LAMP-POST FOR MARKET-ST. BRIDGE, PHILADELPHIA, PA. MR. PAUL BRANDNER, ARCHITECT, PHILADELPHIA, PA.

WROUGHT-IRON WORK DESIGNED BY MR. C. J. BROOKE.

Worn-out Boilers not Safe for Heating-Boilers.—It is a mistake often made to assume that an old worn-out boiler is "good enough for heating," says *Iron.* While it is true that a boiler which may not be strong enough to run at eighty pounds pressure will answer very well to run at a somewhat lower pressure, we do not think it quite safe to use for heating, or any other purpose, a superannuated or worn-out boiler. In many cases it is not the steam pressure itself which is alone to be considered, but the strains resulting from continuous use, to which every boiler is subject, without regard to the actual pressure carried. If the boiler has been used for a long period, and there is the slightest ground for thinking the plates unsound and brittle, it should be rejected for all kinds of work. It is a mistake to suppose that no serious explosion can occur if the pressure does not exceed twenty-five pounds per square inch. Many very destructive explosions have occurred at these pressures, and will continue to occur so long as unsound boilers are used.

UNITED STATES GOVERNMENT BUILDING PRACTICE.[1]—VII.

TERRA-COTTA WORK, ARCHING AND FIREPROOFING.

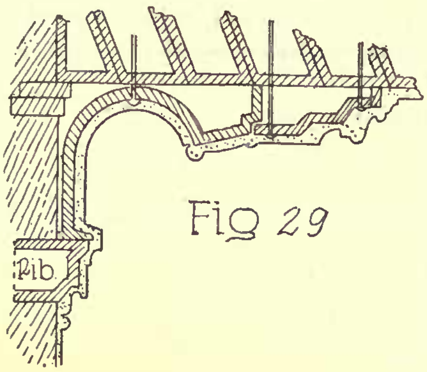


Fig 29

The subject of fireproofing is one which for the past twelve years has received a great deal of attention, both as regards to effectiveness and cost.

The generally accepted definition of a fireproof building is, that it is one the constructive portion of which cannot be destroyed or injured by an ordinary fire, which would burn up all the combustible material in the building; by constructive portion is meant the walls, floors, stairways and roof.

Walls built of stone or brick are generally considered to be fireproof; for the remaining construction, iron or wood must be used for the framing.

Iron though a non-combustible material is not fireproof, unless amply protected from bending or otherwise losing its strength by the action of heat. Wood is a very combustible material, but is not injured by heat if kept entirely from contact with fire. It then becomes a question to be carefully considered whether the best results are to be obtained by endeavoring to protect iron from the action of heat or wood from the contact of fire, and then to consider the cost of each. As to the best method of the two, there is, of course, difference of opinion, which need not be discussed here: as to the cost there can be no doubt that wood is much the cheaper, practically costing only about half as much as iron with fireproofing.

The fireproof buildings constructed by the Government have almost invariably been constructed of iron, which has not always been properly protected from the action of heat. The only exception is the United States building at Aberdeen, Miss., now being constructed of wooden floors and roof, with timbers, joists, etc., thoroughly encased in terra-cotta.

In the post-offices at New York and Boston, and the custom-houses at Philadelphia, Cincinnati, Chicago and St. Louis, which are usually considered first-class fireproof buildings, no provision whatever is made to protect the iron columns (of which there are a great number in each building) from heat; while all the exterior door and window frames of these buildings are made of cast-iron with fireproof shutters, at great expense, the contracts for these in each building having been from $70,000 to $100,000.

The fireproofing of buildings constructed of iron will first be considered, which consists of floor-arching between beams, encasing of columns, furring of cornices, boxing-in of girders, ceiling-plates and roof-tiles. Terra-cotta is generally used for all of the above purposes though floor-arching may be of corrugated iron, brick or terra-cotta.

SPECIFICATION.

The contractor to furnish all labor and materials, brick, terra-cotta, centring, concrete filling of haunches, of arches, skewbacks on beams and girders, etc., as shown on drawings and called for in the specification.

Proposals must be made in a lump sum for all the work required; also must be stated, in case any additional work may be required, the price per square foot for floor-arching, roof-tiles, column-casings and ceiling-plates, and the price per lineal foot for each different cornice, furring and girder-boxing, which must include all labor and materials for putting same in place.

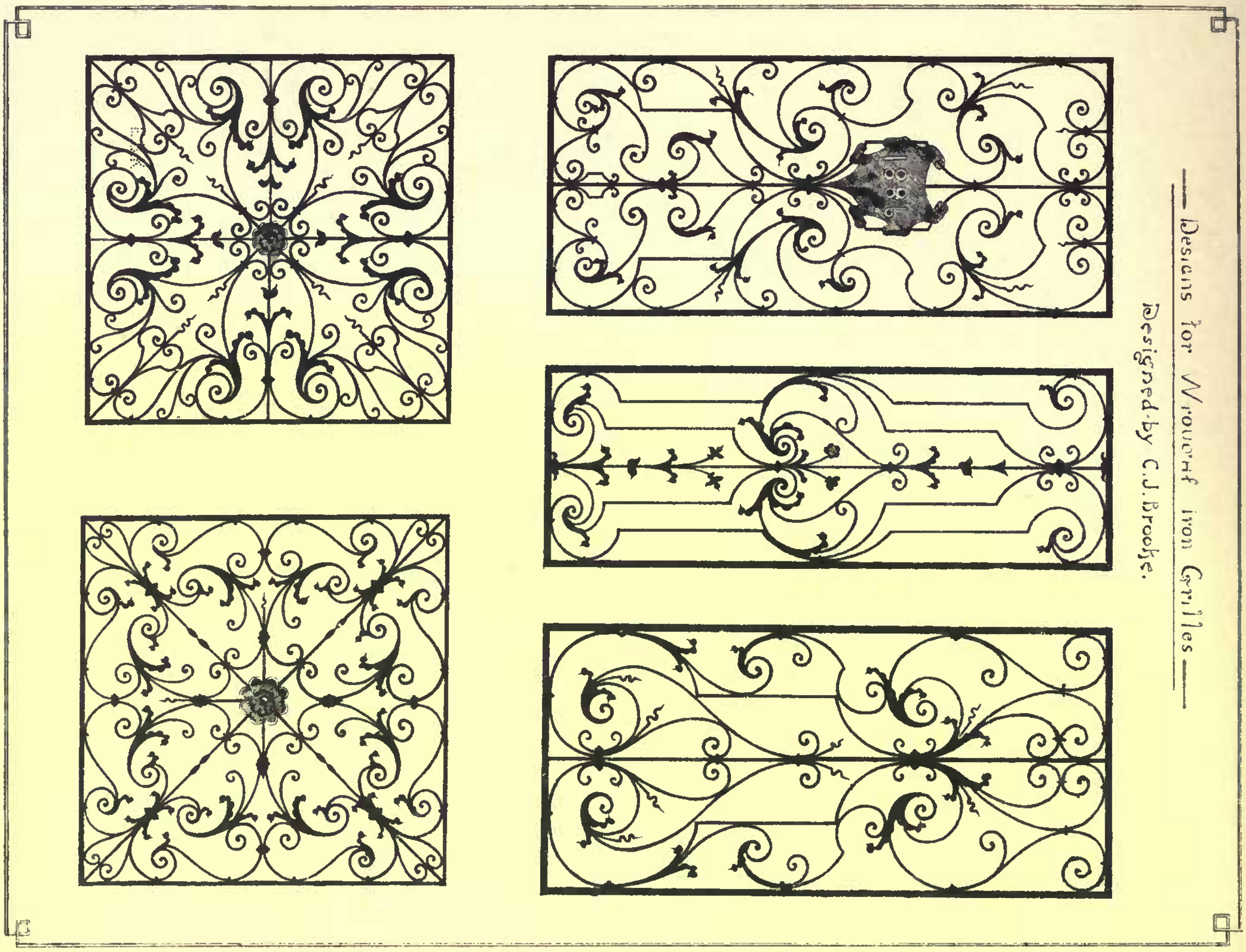
Corrugated-Iron Arching.—This kind of arching [which is seldom used now], to be of No. 18 B. W. G. black iron lapped at joints one corrugation, and the corrugation to be not less than ⅜″ deep; the arch to have a height from springing to crown of not less than 4″ nor more than 8″; the arches to rest on the flanges of beams or on angle-irons, bolted to flanges of beams as required.

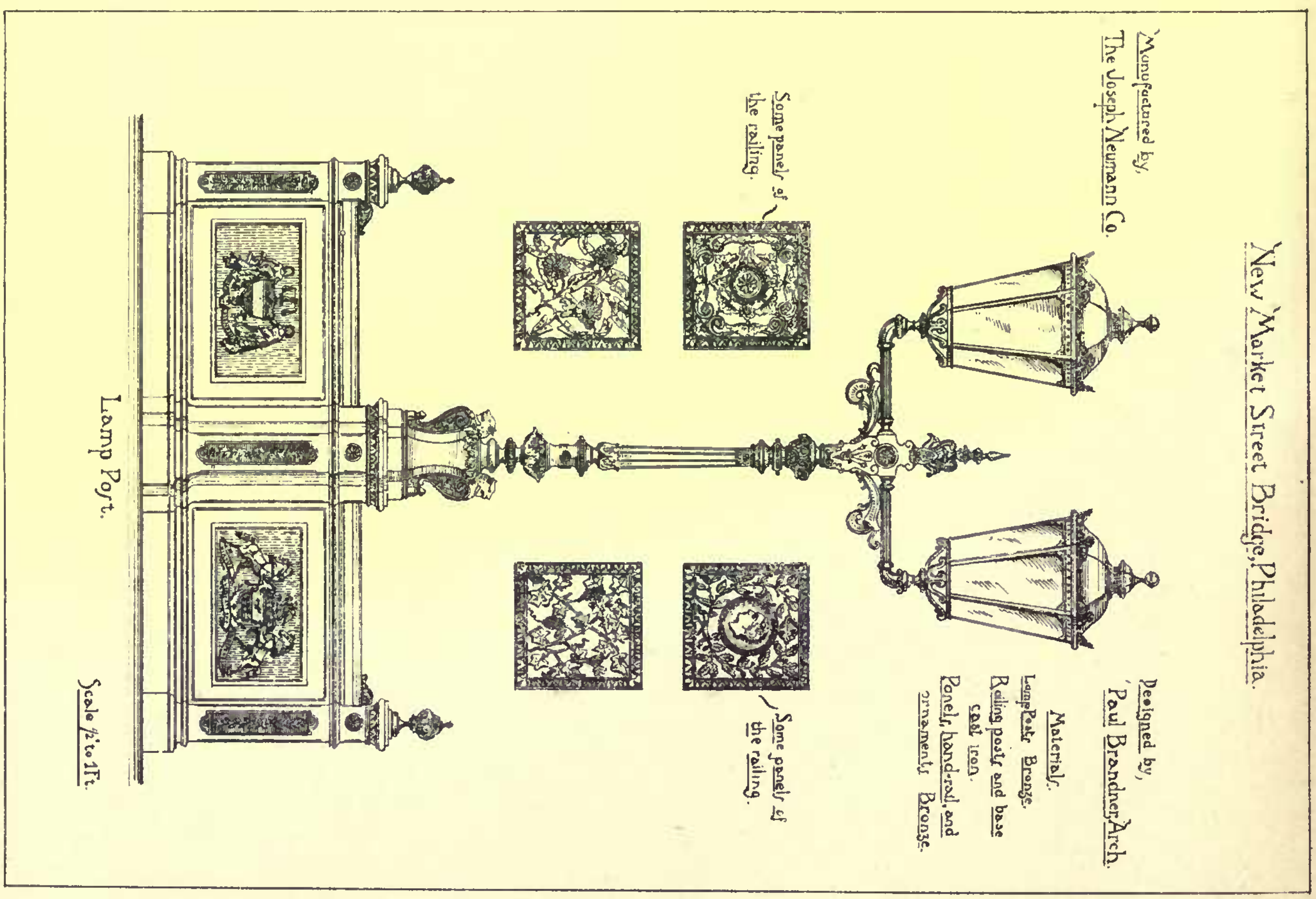
Where corrugated-iron arching is used, it is necessary to furr down and use either terra-cotta tiles, iron or wire-cloth lathing on which to plaster, in order to protect the iron from the heat and also to provide a flat ceiling.

Centring.—For all brick and terra-cotta arches, wood centring, scaffolding and cambers to be provided, to be strongly built and firmly fixed in place before the arches are built. The slats forming centres to be close together to hold the layer of mortar for bedding the bricks in. The centres are not to be struck or eased until the mortar is set hard enough not to run through the joints.

Brick-Arching.—The entire first tier of beams, which is usually the entrance floor, to be arched in one half-brick ring. All the vault arches throughout to be in two half-brick rings. The arches to start from brick skewbacks, built in walls and from brick skewbacks which must be furnished by the contractor, moulded to fit lower flange and web of beams. The bricks to be laid dry with open joints well bonded and breaking joints bedded in the mortar on centres, and

[1] Continued from page 66, No. 606.



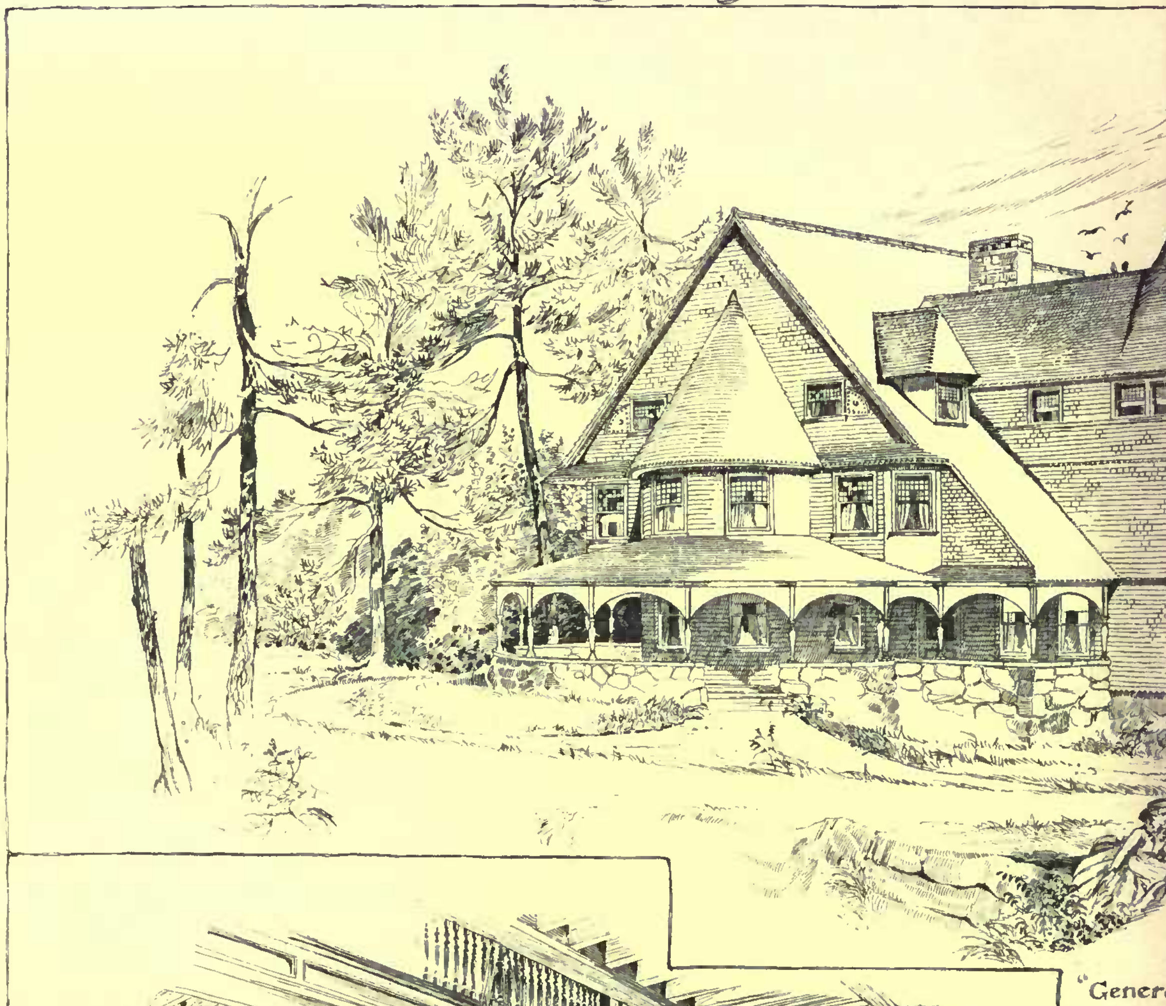


Heliotype Printing Co. Boston

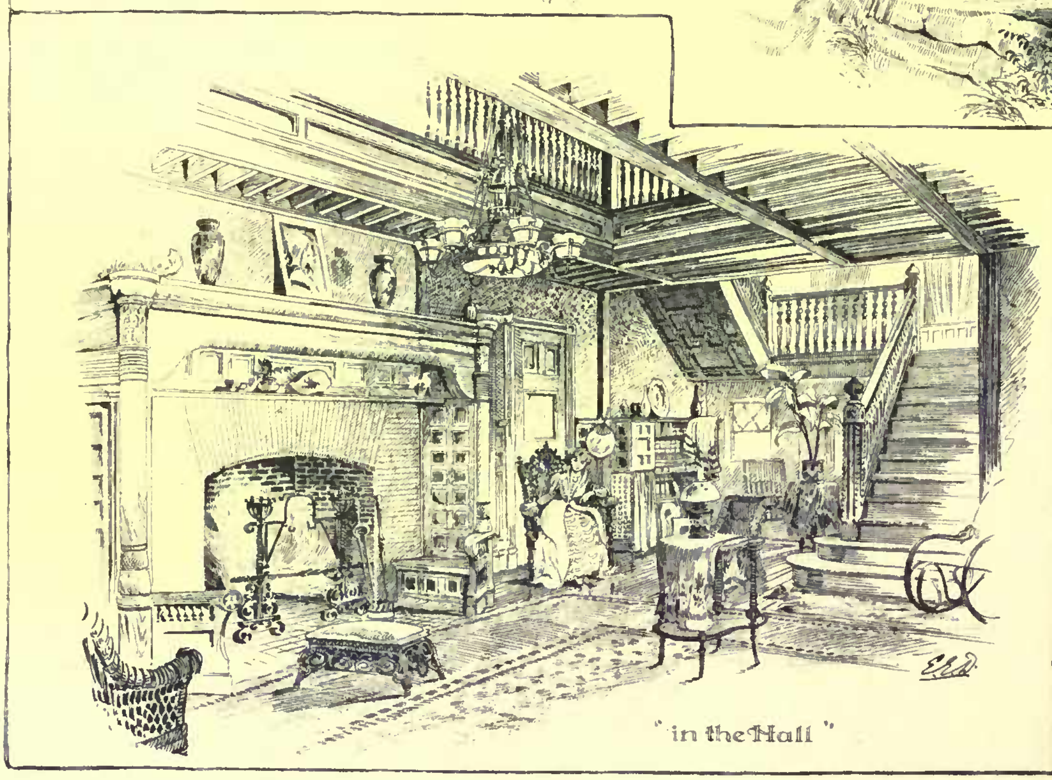
American Architect and

Summer Cottage on Friendly Island. Alexr. Bay. St Lawren
for E.W. Dewey. Esqr. New

Wilbur. S. Knowles. Architect 189 Broadway N.Y. City.



"Genera



"in the Hall"



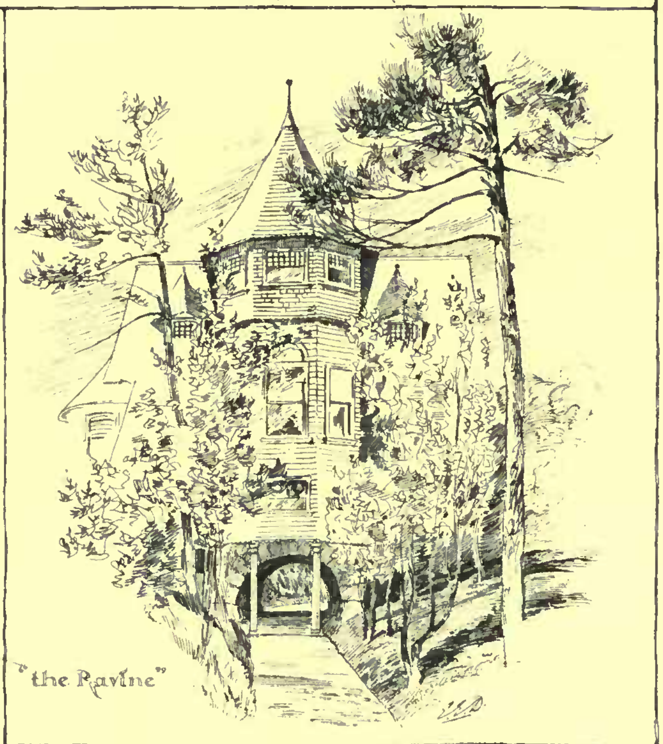
River.



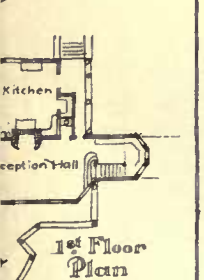
View from the River.

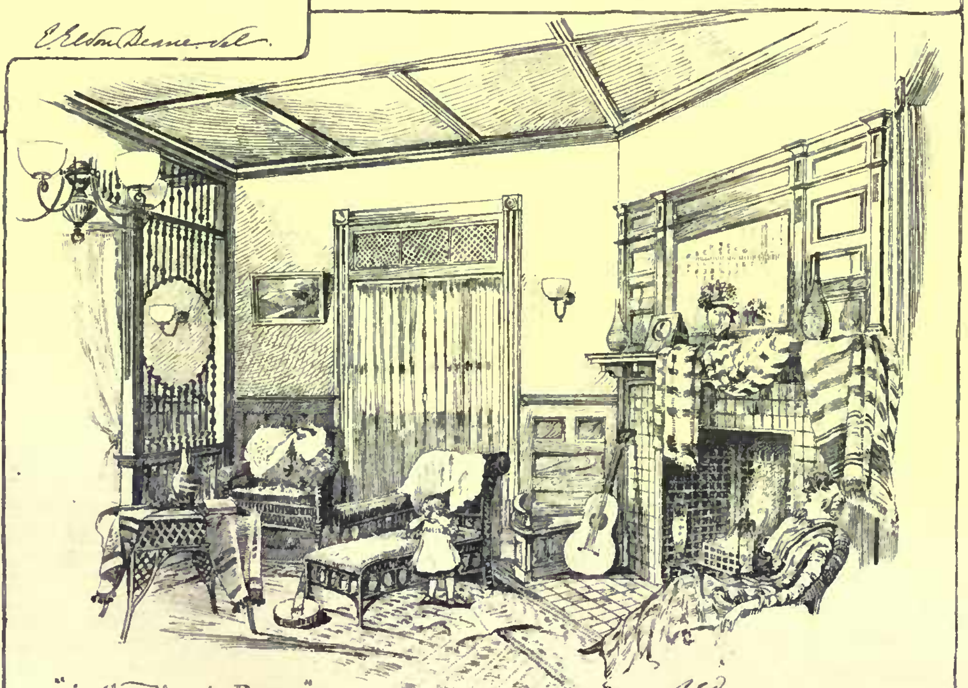


C. Eldon Deane del.



"the Ravine"





"in the Music Room"

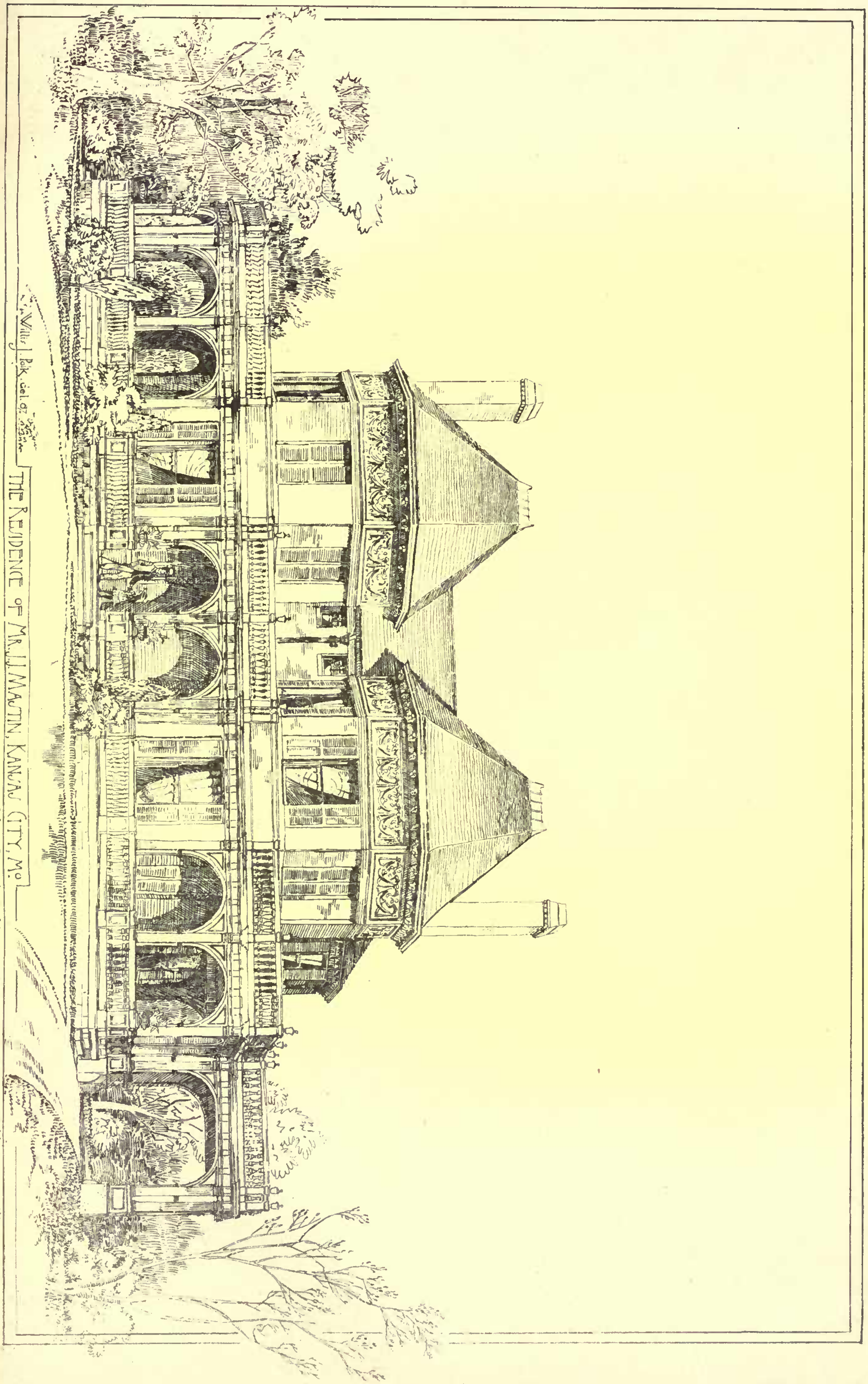
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AMERICAN ARCHITECT AND BUILDING NEWS, DEC. 3 1887. No. 623



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THE RESIDENCE OF MR. J.J. MASTIN, KANSAS CITY, Mo.

Van Brunt & Howe · Architects · Boston & Kansas City.

after arch is complete the joints to be thoroughly grouted with liquid cement-mortar, well poured and worked into the joints with a trowel, until thoroughly filled so as to make brickwork solid and firm.

Where the skewbacks used do not protect soffits of beams, and it is found that such protection is necessary or that the ceiling must be plastered, nails are driven in between the flange of beam and skewback on each side about 4″ apart, and wire wrapped around nails, passing diagonally on beam soffit from nail to nail, and the beam soffit and arch plastered; the beam soffit is often ornamented by plaster mouldings and enrichments which forms additional protection.

Terra-Cotta. — All the terra-cotta for arches, furring, roof-tiles, etc., to be best quality fire-clay, mixed with 25 per cent of potter's-clay; if of brick-clay it must have a proper proportion of fire-clay mixed with it; the roof-tiles must be made porous so that a nail may be driven into, without breaking, them and hold; all to be moulded fair and true, thoroughly and evenly burned, free from cracks and defects, and each piece to be roughly scored or channeled to afford a suitable key for the plastering and when struck with a hammer to have a good, clear ring.

Arches. — The arches to be hollow with the necessary stiffening ribs, to rest against walls on brick offsets built for them, and where chases interfere a 3″ x 2″ angle-iron at same level as offset to run across chase and be secured at each end to wall by expansion bolts ½″ diameter 6″ long, and at beams the arches to have skewbacks fitting flanges of beams; the voussoirs and keys to vary in width sufficiently to fit the various spans of the floor beams, which are generally spaced about 4′ 6″ apart; various depths of beams are used, but all the arches are to be 9″ deep, or what is known to the trade as a 9″ flat arch. As some of the beams are less than 9″ deep, smaller sizes of skewbacks must be provided for them, and the connection to body of arch made by a special or reduced voussoir.

The soffit of each floor beam to be covered with a slab of tile, so formed as to fit closely and to be supported by the skewback on each side of beam.

Setting. — The arches to be thoroughly bedded in mortar and rubbed to a close joint; butt-joints to be neatly made and properly broken, and all cavities to be filled up.

The beam soffit tile to be bedded in mortar and shoved to place, and all joints to be well pointed. No clipped or broken tiles to be allowed in the arches, and no cutting of arches will be permitted except where absolutely necessary and under the approval of the the superintendent. All the arches must be formed to fit the various spans of the floor beams, and in all cases where necessary special patterns of voussoirs or keys must be moulded and set where it is impossible to set the regular form. No joints must exceed 3-16″ in thickness.

The arches when completed to be guaranteed to sustain with safety a load of 500 pounds per square foot of surface without deflection.

Cornice Furring. — The furring of cornices, boxing of girders, etc., to be of profiles and sections with the necessary ribs as shown by drawings, or bidders may submit prices for furring of same general outline, but of different section. The cove and ceiling piece to have holes cast for bolts, spaced not over 12″ apart (at least two bolts for each piece), the furring to have all the necessary external and internal angle pieces, or to be properly and securely mitred at angles; all to be close-jointed and properly bedded in mortar; the cove and ceiling piece to be substantially fastened in place by ¼″ diameter T-head bolts, spaced not over 12″ apart, with nuts and washers to each. Cornice furring as per Figure 29, is the style generally used.

Fireproofing of Columns. — The shafts of columns from lower to upper flanges to be covered with terra-cotta, corrugated on the inside; to be 2″ thick, and to have proper and approved method of fastening together and to shafts; to be bedded and close-jointed in mortar and left ready for plaster finish; where the shafts of columns are tapered, the covering must be properly fitted to them. The entasis of columns is formed in the plaster finish.

Ceiling-Tiles. — Ceilings where no floors come over them, usually have 3″ hollow tile supported on 3″ x 2″ ⊥ iron purlins spaced 16″ apart suspended from iron beams, or may have 2″ solid tile supported on 2″ x 2″ ⊥ iron purlins spaced and suspended in the same way; or thin tiles about ¾″ thick may be used with flanges so arranged as to hang from 1½″ x 1″ L irons spaced 16″ apart; the hangers should be long enough to keep the tile 2″ below bottom of beam. All ceiling-tiles should be properly scored or channeled to form a key for plastering.

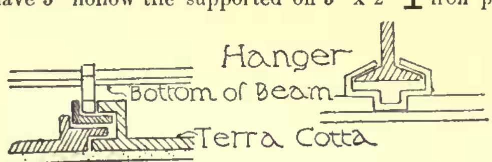


Fig 30

Roof-Tiles. — The tiles for roofs to be 2″ thick solid or 3″ thick hollow, and must be moulded to fit between and rest on the flanges of the 2″ x 2″ ⊥ bar roof purlins, which are spaced 16″ on centres, both sides of tiles to have fair surfaces and square side joints.

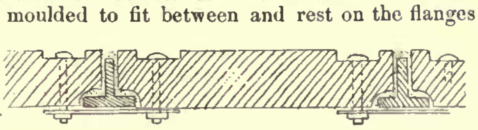


Fig 31

All the tiles to be bedded in cement-mortar, and the tile on the steep parts of roof to be secured by bolts (on the flat roofs the bolts are unnecessary.) The bolts to be 3-16″ diameter to run through the tiles, having 1½″ square sheet-iron washers on outside, and on inside to have plates 1½″ x 5″ crossing under the purlins from tile to tile, with the nuts of bolts on inside.

Mortar. — The mortar for setting all terra-cotta arches, furring blocks, column casings, roof and ceiling tiles, whether secured to wood or iron, to be composed of one part rich lime paste, two parts best-quality, fresh-ground, American hydraulic cement, and six parts clean, sharp sand, mixed measure for measure immediately before using.

Concrete Filling over Arches. — The concrete filling over all arches to be composed of one part cement, two parts sand, and six parts small broken stone, brick-bats, furnace-slag or cinders, to be thoroughly mixed and incorporated together, using sufficient water, and to be well rammed over arches and levelled off to bottom of flooring; and where marble tiling is to be laid, to be levelled off to ½″ below bottom of tiling.

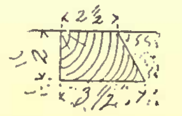


Fig 32.

For all floors where dressed flooring is to be laid, wooden sleepers of the size and section shown, to be laid and firmly bedded in the concrete, spaced 16″ on centres, with broad side down, the upper surface to be perfectly flush with concrete.

The contractor will be required to measure the quantities for all terra-cotta work and other materials at the building before shipment, as no claim for material delivered and not used will be allowed.

Fireproofing Woodwork. — Buildings constructed with wood floor-joists and roof have iron columns and girders to sustain the walls and floors, which are usually made fireproof, as already described for iron structures. For protecting wooden floor-joists, ceilings and roof, the cheapest method is by the use of wire-cloth or iron-lathing, which should cover all ceilings, stud-partitions, etc.; also the entire roof may be covered with wire-cloth lathings, plastered, on which the slate or copper may be secured by copper wire passing through holes in the slates or copper tags, and in through holes punched in the plastering and tied on the under side. This method is very simple, but great care should be taken to cover every portion of the space, ceiling, partition and roof, from brickwork to brickwork, keeping the lath at least ⅜″ away from the woodwork by the use of staples driven over iron spools or sheet-iron strips, which will also serve as stiffening-ribs for the lathing; the plastering should extend ⅜″ behind the lathing, and have the usual thickness, ¾″ on front, and should be made without plaster-of-Paris. This system has frequently been used for ceilings and partitions by the Government, but not for what are usually considered fireproof buildings.

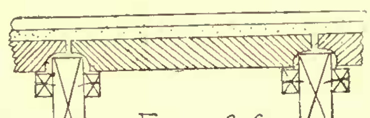


Fig. 33

Where the above method is used for ceilings, etc., the floor-joists are covered with rough, undressed boards; on these is placed an inch-thick coating of cement-mortar, in which are bedded the floor-strips, on top of which is secured the dressed flooring.

The most substantial protection for wood, as well as iron work, is terra-cotta. On top of floor-joists porous terra-cotta tiles 2″ thick are to be placed, having 1″ rebate at ends, and to rest on joists and on 1″ x 2″ strips, which are to be properly secured to floor-joists, which are spaced from 12″ to 16″ on centres, the tiles to be bedded on top of joists in mortar, with which the butting-joints are to be filled; on top of these tiles 1″ or 2″ thick concrete is usually placed, in which is imbedded the floor-strips.

All ceiling-joists, stud-partitions where necessary, and under side of rafters where exposed in rooms and halls, should be thoroughly covered with porous terra-cotta from wall to wall, so that if plastering is broken by any means, fire will find no crevices to get into the woodwork. The joists, studs, and rafters, and furring-pieces where necessary, should be spaced not over 16″ on centres. It should not be forgotten to carefully calculate the loads for floor-joists, rafters, etc., taking into account the additional weight of the terra-cotta.

Ceiling-tiles are made from ⅝″ to 2″ thick; when 2″-thick tiles are used they are generally solid, and are secured on the joists, etc., without any space intervening, by screws or wrought nails, with 1½″ or 2″ square sheet-iron washers let in flush with the surface on which the tiles are supported, as shown in Figure 34. Tiles ⅝″ thick, with the necessary ribs and flanges all around, so as to keep the surface about 2″ from the wood, are also made and secured to the wooden joists in the same manner. The latter method is the cheaper of the two and the one generally used, as the air-space between the tile and the wood is better than the solid tile.

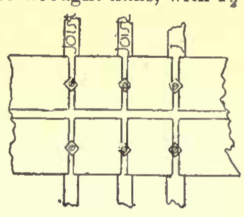


Fig 34

Figures 35 and 36 are methods often used for securing the thin ceiling-tiles in place and keeping the surface the proper distance from the joists, using band-iron fastened to wood by screws or wrought nails.

It will always be found cheaper to put in a regular tile partition from 3″ to 5″ thick, than to make a stud partition covered by tiles on both sides, and the latter should only be done when it is necessary

to frame or truss the partition to support itself without bearing its weight on the floor.

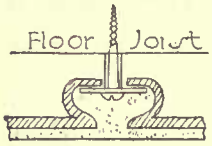


Fig 35.

Terra-cotta tiles are seldom used on top of wooden roofs under the roof covering, but tiles like those for ceilings and partitions can easily be applied to steep roofs, and like those on top of floor-joists for deck roofs.

The factories have regular stock sizes and shapes, which they make for all of the above-mentioned purposes, which, of course, are cheaper than special patterns, but any desired size and shape can easily be made to order.

MEASUREMENT.

Terra-cotta for fireproofing is usually measured by the square foot, giving the kind and thickness. The arches and ceiling-tiles, when set, to be measured from wall to wall, or from wall to web of girders or trimmers, as the case may be; the covering for shafts of columns to be measured on the outside girth at base by the extreme height; the furring for cornices to be measured by the lineal foot, giving girth, to the extreme ends of angles, mitres, etc., or, if angle-pieces are used, between the angles, and the angles counted at so much each; the roof-tile to be measured by the square foot as delivered, or, if price includes putting in place complete, by the actual roof surface on outside of tiles, allowing nothing for wastage. The above are the rules for measuring contract work.

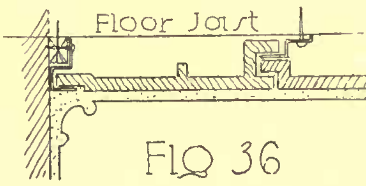


Fig 36

In estimating for roof-tiles, partitions, etc., where cutting of tiles is necessary, the measurements should be taken large to allow for wastage, but for floor-arches, which are usually made to order for special spacing of beams, this is not necessary.

COST.

The cost of fireproofing depends principally upon the kind of materials, or method employed for the purpose, and the freight on the materials to the buildings where used.

Brick arching usually requires from seven to eight bricks per square foot, and the average weight of a half-brick (or 4") arch, including concrete-filling, is about seventy-five pounds per square foot of floor-surface; the cost averages from 25c. to 30c. per square foot, including cost of centring.

Corrugated-iron arching is measured by the square foot and costs about 20c., varying from 12c. to 25c. according to locality; it weighs, with the concrete-filling over it, about the same as brick arching. This arching requires no centring.

Terra-cotta arching is made from 4" up to 15" thick, and the average weight per cubic foot is forty-four pounds; the weight of the concrete-filling on top should be added to this; it costs, furnished and set in the building complete, 4" arch about 20c., 5" 22c., 6" 24c., 7" 26c., 8" 28c., 9" 30c., 10" 34c., 11" 37c., 12" 40c., and 15" 50c. The 9" arch is the one generally used by the Government, average weight per square foot, with concrete, about forty-five pounds, and it is seldom that a thicker arch is needed; these have cost at Syracuse 26c. per square foot, Terre Haute, 28c., Buffalo, 30c., Jefferson City, 32c,, and Dallas, Tex., 42c.

Centring for brick and terra-cotta arching costs from 8c. to 10c. per square foot, which is included in the above prices.

Concrete-filling over arching costs from 5c. to 10c. per square foot, at Syracuse, 5c., Toledo, 9c., Peoria, 8c., and Lynchburg, 7c.

Partition-blocks are generally made in sizes 18" x 24', from 2" to 8" thick, and weigh, including average hollow, about thirty-six pounds per cubic foot. They cost, furnished and set complete, 2" about 10c., 3" 12c., 4" 14c., 5" 16c., 6" 18c., 7" 20c., and 8" 22c.

The cost of column-covering, 2" thick, varies greatly; at Baltimore, Md., and Columbus, O., 16½c. per square foot, at Syracuse, N. Y., 18c., Fort Wayne, Ind., and Jefferson City, Mo., 45c., Hannibal, Mo., and Harrisonburg, Va., 52c., Pensacola, Fla., 62c., and Dallas, Tex., 68c.

Terra-cotta cornice-furring costs, furnished and set complete, about 20c. to 25c. per superficial foot, taking extreme girth, but dependent on the outline.

Ordinarily, wall-furring blocks are made 1½", 1¾" and 2" thick, hollow, in sizes about 2' x 1', and cost, furnished and set, from 7c. to 9c. per square foot.

Ceiling-plates cost from 10c. to 12c. per square foot, furnished and secured to iron beams, and from 8c. to 10c. to wooden joists.

Terra-cotta floor-tiles on wood joists are usually made 2" thick, about 2' long, and from 12" to 16" wide, and cost furnished and set, from 10c. to 15c. per square foot.

Roof-tiles are usually made 2" thick, 2' long, and cost, furnished and set, including bolts and washers, about 15c. to 20c. per square foot; at Baltimore, Fort Wayne, Columbus and Syracuse, 13c., Harrisonburg, Pensacola and Toledo, 15c., Peoria, Ill., 18c., Quincy, Hannibal and Jefferson City, 20c., and Dallas, 30c.

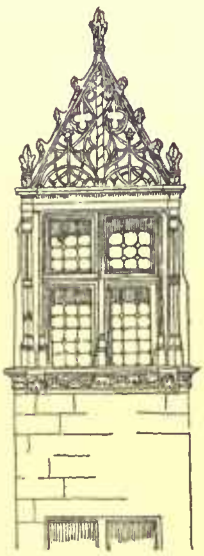
Lathing and plastering will be treated in subsequent chapters and it need only be said now, in regard to fireproofing woodwork by this process, that it costs for iron-furring and lathing, including the extra thickness of plastering, about 15c. per square foot more than ordinary wooden lathing and plastering, and wire-cloth lathing, with extra plastering, costs about 5c. per square foot more.

Jas. E. Blackwell.

[To be continued.]

HINTS FOR BUILDERS.[1]—V.

WARMING AND VENTILATION.



Window from House at Perigueux.

I WOULD warn the student that, although the power of warming or ventilating is not at all difficult of acquirement, yet the art of warming and at the same time ventilating a room or building is a difficult one, and, though so apparently similar, are yet totally dissimilar, while, even in these advanced times, the latter, or true art, is one which is far indeed from having attained to anything like a degree of perfection. In this connection, my readers will not find a knowledge of chemistry come at all amiss to them, for this reason, that in order to arrive at satisfactory results in the arts of ventilation and warming — which should never be separated — it is advisable to be thoroughly well acquainted with the chemical conditions which surround the question. Now the combustion of fuel and the respiration of animals are very identical chemical processes in that they need for their successful accomplishment a never-ending supply of oxygen, which is usually afforded by the atmospheric air. A man of the ordinary weight and stature absorbs in the course of every twenty-four hours 9 ounces troy of carbon, the consumption of carbon during this same period being equal to 24 ounces, or 19.4 cubic feet, the quantity of air vitiated during the same time amounting to 97.2 cubic feet, and the product in carbonic acid to 33 ounces.

The products of combustion and respiration consist principally of carbonic acid mixed with the nitrogen of the air, both irrespirable gases, and which, if taken into the human body without being extensively diluted with air, would cause death. Now in the grand and wondrous economy of Nature, it has been so ordained that the poisonous products of combustion and respiration shall form, as it were, an aerial manure or fertilizer to the vegetable kingdom, supplying it with materials for growth, the organs of plants being so constructed that in appropriating and assimilating this aerial manure or waste, they in turn give fresh supplies to the atmosphere of pure oxygen; in other words, they inhale carbonic acid, or death, and exhale pure vital air or life. By the same wise ordination, the air vitiated by combustion has a strong power of ascension, due to its high temperature and consequent lightness, so that, mixing in the atmosphere, it is blown hither and thither by the winds or absorbed by the rain, whence it is distributed far and wide. So, consequently, with respect to the products of respiration. The vitiated air as it leaves the lungs has very nearly the same temperature as the blood, viz., 98°, and consequently, being specifically lighter than the surrounding air into which it is exhaled, it ascends and escapes to a higher plane. Hence, in the open air the process is perfect, there being not the slightest impediment to the immediate ascent of the bad air, but in buildings of whatever description, as usually constructed, the case is otherwise, as the vitiated air, whether it arise from combustion or respiration, rises upwards to the roof or ceiling, where, if it cannot find an egress, it accumulates, gradually becomes cooler and falls, and, mixing with the fresher air, is again inhaled into the lungs and exhaled again, doubly charged with poison, to the manifest injury of the persons breathing this poisoned atmosphere.

When the subject is examined, it appalls by its vastness, and I would, therefore, recommend every youth who may be in any way connected with the architectural professions or building trades to make himself acquainted, to a certain extent, with chemistry — to an extent, that is, to understand the laws governing the human system and its functions.

Of course, if every ceiling and roof were provided with openings by which the bad air could escape to the outer atmosphere, much illness would be obviated and life generally made more enjoyable, but, as the most elementary architect knows, there are a variety of difficulties surrounding the cutting of a hole in the roof, notwithstanding that the matter at the first blush looks an uncommonly simple one — thus, the room would not be so warm, the air would probably come in as a cold draught, while noise would be admitted from the outside, though it must always be borne in mind that in ventilating any enclosed area, the exit for the foul air must be at the highest possible point on account of the buoyancy of the vitiated air, the fresh air being, of course, admitted from the lowest possible point.

In touching briefly upon the various methods which have been

[1] Continued from page 112, No. 610.

adopted for the warming of buildings, both domestic and commercial, I do not think I can do better than begin with a glance at the open fire — at once the simplest and at the same time the most universally adopted of the many systems at different times brought forward. Strange as it may seem, it is a fact that in all countries where fuel is a scarce commodity the inhabitants suffer both mentally and morally, being alike stunted in body and mind — thus, in France, where fuel is scarce, the average height of a man is five feet four inches; in the Netherlands, where fuel is more plentiful, five feet six one-third inches; in England, where fuel is on the whole abundant, five feet nine inches, and in Sweden, six feet. It is not necessary here to touch upon the various methods pursued in different countries to obtain warmth, though I pause to remark upon the similarity of the plan adopted by some Chinese of the present day with that pursued by the ancient Romans, who employed a system of flues carried round the apartment beneath the floor, the stove being outside the building. Before the introduction of the chimney, the ancient halls of England were heated by a fire kindled in the centre, the smoke from which escaped from a hole in the roof, fitted with a turret or louvre, a plan not very dissimilar from that adopted by the Indians, Arabs and Esquimaux. It was after the Conquest that chimneys first came into use, and the fireplace was affixed to the wall. Following after the recesses in which the fire-logs were burnt came the ordinary fireplace in the improvement of which Savot was the first to move, he raising the hearth and lowering the mantel, the opening of the fireplace being about three feet high, and formed like an arch, and thus the draught was accelerated much in the same way that persons in a smoky room open the door or a window to accomplish a similar end. From this it will be seen that an upward draught is an essential in building construction if the room is not to be deluged with a black cloud of smoke, and it is in effecting this, without taking all the heat up the chimney as well, that engineers have had to overcome great difficulties, and a study of which will well repay the building student. The following remarks, which were in the main written over 150 years since, will well bear careful remembrance, and I commend them to my young readers: "It appears that those who have hitherto built or caused chimneys to be built, have only taken care to contrive in the chambers certain places where coal may be burnt, without making any due reflection that the coal in burning ought to warm those apartments and the persons who are in them; at least it is certain that but a very little heat is felt of the fire made in the ordinary chimneys, and that they might be so ordered as to send forth a great deal more, only by changing the disposition of their jambs and wings." The means by which a fire may communicate heat to a room are by radiation, reflection and conduction. Radiant heat is governed by the same law as radiant light, *i. e.*, the angle of incidence is equal to the angle of reflection, hence, it necessarily follows that in a fireplace with straight jambs, very few of the rays are reflected into the room. In 1713, onwards, Cardinal Polignac introduced several modifications into kitchen ranges, many of which were really admirable improvements upon Savot's ideas, but as these have all been long since superseded, I shall not refer to them.

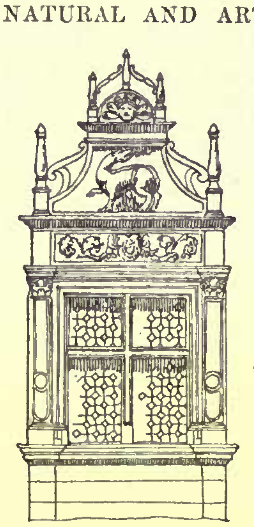
The best form of register stove of moderate size for diffusing the heat into the room is that which describes a triangle. In this the sides form a right angle and the bars describe a quadrant of a circle of which the radius should be half the length of the sides, and the back one-third the width of the front. In this way the sides of the stove form an angle of 135 degrees with the back, and all the rays of heat which impinge on these sloping sides are reflected into the room in front of the stove in right lines. The falling cover or register top should form an angle of 135 degrees, with the back likewise, when it will send heat down into the room. In places where fuel is scarce the close stove is used, and in the north of Europe the stove is constructed with a view to the economy of fuel. Our space does not permit us to go over this ground of the various stoves, but we must warn students that the objects to be aimed at are the warming of the room, and *not* the chimney, consistently with proper, but not draughty ventilation; the safety of the stove, in order that the house is not set fire to, and the picturesque and harmonious appearance of the fireplace and its appointments with the furniture and style of architecture of the house. Although open stoves are generally preferred for domestic use on account of their cheerful appearance, still for the heating of large buildings there is nothing better than hot-water pipes for the sustaining of an equable temperature, but as the laying of these, like ranges, grates and stoves in reality does not legitimately come within the province of the builder but belong to the gas engineer, I shall not revert further to them here.

W. N. BROWN.

[To be continued.]

A SCANDALOUS STRIKE. — Last Saturday morning one of the bricklayers at work on the large New Arcade building, being erected by Mrs. D. G. Bush at Bellefonte, Pa., struck Mr. C. L. Calloway, who is superintending its erection. The latter at once had him arrested and subsequently discharged from his service. To-day all the other bricklayers refused to work unless their comrade be taken back The consequence was idleness to-day on the part of the workmen, but as matters have been adjusted this evening, work will be resumed to-morrow morning. — *Philadelphia Press, Nov. 29.*

NATURAL AND ARTIFICIAL HYDRAULIC CEMENTS.



WINDOW FROM HOUSE AT PERIGUEUX.

AT the last meeting of the Society of Arts held at the Institute of Technology on Thursday, November 10, Mr. U. Cummings, of Buffalo, N. Y., read a paper on "Hydraulic Cement, Natural and Artificial; their Comparative Values."

Mr. Cummings said: There are two kinds of hydraulic cement, the artificial or so-called Portland and that produced from natural cement rock. The natural cements were used in all the old engineering works in Europe, while the Portland cements were not manufactured in England till about 1824. The early history of Portland cement is filled with failures and disasters, and it was not until about 1860 that it was used to an extent worth mentioning, and it did not obtain a sound footing until about 1874. There had been but little done in the way of tensile-strain tests until 1858. It was discovered soon that the artificial cements would, if well manufactured, sustain a higher tensile strain than the natural brands, and this naturally and rapidly led to a belief in their superiority.

All hydraulic cements, whether natural or artificial, are produced by a mixture of clay and carbonate of lime, or lime and magnesia. These two ingredients are usually mixed together in a pug-mill with a free use of water. Sometimes they are ground together in a comparatively dry state. But in either method the quality of the cement depends greatly on the thorough admixture of the two materials — it being more important even than a proper combining proportion, although the latter is essential to the production of a first-class cement. After these materials are incorporated into a homogeneous mass, it is dried and made into blocks and placed in suitable kilns for calcination. The preliminary operation in calcination is the expulsion of moisture, which is soon followed by the carbonic acid contained in the carbonate of lime. Then a chemical reaction takes place. Under a high temperature, the lime rendered caustic by the expulsion of the carbonic acid and in intimate contact with the silicate of alumina, the latter is decomposed, and a new combination is formed, known as silicate of lime and alumina. If magnesia be present, then a triple silicate of lime, magnesia and alumina is formed.

In a Portland cement each atom of silicate of alumina must come in close contact with its equivalent of lime carbonate. A failure in this regard will result in the production of a cement that will heat, check and expand, thus showing the presence of free or caustic lime or free clay, and no amount of subsequent grinding or mixing will change these conditions.

[The speaker quoted from Henry Reid's work on Portland cement, to show that its manufacture will be attended with a danger that must ever be constant, so long as the matter of mixing is entrusted to human hands.]

While Nature did not always deposit her natural cement rock formations in true combining proportions, no handicraft has ever yet excelled or even approached her in the art of mechanical combinations of clay and carbonate of lime, for with natural cements, however much the proportions of ingredients may vary, as between the upper and lower layers there is usually a large percentage of the bed that is so well proportioned as to yield a good cement when all are mixed together; and even the layers that are not well proportioned, owing to their finely commingled condition, are not as dangerous an element in the mass as is that of an equal amount of an imperfect mixture in an artificial cement. As a rule, the lower layers contain more clay than those above, the proportion of clay gradually diminishing and that of carbonate of lime increasing as we ascend in the series of layers. This variation in proportion in the several layers amounts in some deposits to twenty per cent, and so it may be seen that although the cement produced from such deposits may after a thorough mixing, first in the kiln and then in the grinding, exhibit by analysis a cement made up of very fair proportions, it also shows that it is not impossible to find that a cement may be heavily overclayed and still contain free or caustic lime; and it must be seen that although the proportions may be correct, yet the percentage of true silicates cannot be predicted on such analysis, for the reason that two distinct layers of diverse proportional ingredients, when placed together in a kiln, cannot form a chemical combination, the excess of clay in one fragment cannot combine with the excess of lime in another. Fortunately, excessive varations are rarely to be met with, but it is to these facts alone that may be attributed about all the superiority that can reasonably be claimed for an artificial cement over the natural. And even in this regard the difference is not great on account of the unknown and doubtfully ascertained quantity of moisture in the chalk and clay, varying in the former from ten to twenty-five per cent and in the latter from twenty-five to sixty per cent.

It is also possible to adulterate Portland cement, and according to the printed reports of the transactions of the Association of German Portland-cement makers, adulteration with slag and other similar materials is carried on by some of the manufacturers to an alarming

extent. The maker of natural cements has no occasion to adulterate as there is no material he could use which is as cheap as the cement rock.

The natural cement-rock formations are well distributed throughout the country. They are known to exist in twenty-four of the States, and the supply is practically inexhaustible. There are now upwards of fifty manufactories in the United States, with an output the present year of nearly seven million barrels. This is the best of evidence that the quality has been universally good.

Over eighty per cent of the cement manufactured in this country contains magnesia in proportions varying from five to twenty per cent. The artificial cements contain little or no magnesia. It is claimed by the manufacturers of this grade that a first-class cement cannot be produced with magnesia as one of the bases; but there are many high authorities who dispute this proposition, and especially among the French engineers; and, as to our experience among the natural cements of this country, we find the magnesia cements among the earliest manufactured, and the consumption of upwards of fifty millions barrels of this class, used in the construction of the great engineering works of this country, is sufficient to establish the fact that the triple silicates are equally as durable as the double.

[Mr. Cummings next discussed the combining proportions of the three bases, and the different theories as to the formation of the silicates, and showed that silicates are formed during calcination and not by the action of water afterward.]

It is an error to suppose that the natural cements of this country are all about alike, and that the testing-machine will very quickly tell us whatever differen. es may exist. It is surprising how widely some of our natural cements may vary from the correct standard of proportions and yet sustain a high tensile strain, and be acceptable to the consumer. A well-balanced cement will withstand the action of frost many years, while an overclayed one, whether natural or artificial, will not, and of this the testing-machine gives no indication. If we take two cements, one being natural and the other artificial, and so nearly alike in composition that a chemist could not distinguish between them, the artificial will test higher than the natural product, but can it be truthfully maintained that it is the better of the two? If we are governed by prevailing public opinion we must admit it, for the testing-machine says so. Had the chemistry of cement and the laws governing combining proportions been made more of a study in the past, we should not now see the whole question submitted to this crucial test called tensile strain.

The testing-machine came into use about 1860, and the Portland cements came to be considered as better than the natural because they would stand a higher tensile strain. If the Portlands were superior, it is a little strange that such engineers as Grant, Colson, Mann and others had not discovered it in all the years prior to 1860; although it may be urged that they were confronted with the excellent work done with natural cement, in the construction of the railway tunnels, the heavy stone arches and deep foundations done during the earlier day: there was the great Thames tunnel, commenced in 1807 and completed in 1843, every stone of which was laid in natural cement and stands to-day in all its perfectness, a powerful argument in favor of natural cement. But the tensile-strain fever had set in, and men argued then, as now, that if one cement sustains a higher tensile strain than another it must be better, because it is stronger. And this argument seems unanswerable, and coupled with the fact that it is a quick and ready means by which the engineer may draw conclusions, has been the cause of its adoption to such an extent that to-day the engineer who does not have access to a testing-machine is considered behind the times.

Looking at this question from the standpoint of one who has had over thirty years of practical experience in the manufacture of cement, witnessing the entire rise and growth of this modern giant, the testing-machine, always ready to adopt any and every thing looking to an improvement in the quality of hydraulic cement, studying the action of all the leading brands in the market under varying circumstances, and devoting much time to the deeply interesting study of endeavoring to find the connecting link that ought to exist between high tensile test and first quality, and oftentimes seeing a cement that was notoriously overclayed, test one hundred pounds to the square inch, while another cement, nearly perfect in its composition, testing barely sixty pounds, and the resident engineer deciding unhesitatingly in favor of the higher testing brand, without a thought as to the question of analysis and combining proportions and all that goes to render a cement capable of withstanding the changes incident to this trying climate, with its extremes of heat and cold, we have sometimes been forcibly reminded of the old adage that "a little knowledge is a dangerous thing." During the last summer a professor of high repute in one of our leading colleges condemned outright one of the best natural cements I ever knew—a cement that had been thoroughly tried in the construction of masonry in bridge-piers, where the current was so powerful and the flow of ice in the spring so terrific that the late Colonel Eads declared that no bridge-piers could be built to withstand the shock. I mention this to illustate the working of the testing-machine. If it can deceive a professor in one of our foremost colleges, who can it not deceive?

In our search for the connecting link that, as we have said, ought to exist between high tensile strain and first quality, we have travelled up and down the whole line, commencing with fifty per cent clay and fifty per cent lime, and following along up through its varying mixtures until pure white lime, with no clay, is reached. These we have studied under every conceivable manner of manufacture and subsequent manipulation, studying the varying proportions with all their bewildering and mystifying contradictions, plodding through the many phases that are continually being developed in the course of a long experience in the study of the natural cements of this country, searching the tables of tests made by prominent engineers from time to time, comparing the tables with analyses of the brands tested, weighing carefully every feature that gives the slightest promise of throwing light on the subject, and now, after all these years, we are compelled to admit that we have nct been able to discover the slightest relationship between high test and good quality.

Practical experience teaches that we can find both good and bad cements that will test high, and good and bad cements that will test low. A cement may be so overclayed that in a barrel of 300 pounds there may be but 225 pounds of silicates oı active setting matter, yet I have seen such cements test as high as 100 pounds in twenty-four hours. Such cements, when slightly underburned, behave very well in air or water, the free clay acting as a pozzuolana; excessive heat, however, greatly impairs or destroys the silicates, and, if carried to a high point, the resultant cement becomes inert. With our present modes of burning, there will be variations beyond the control of the burner, caused by changes in the direction and velocity of the wind. Yet such changes have but little effect on cements containing an excess of lime (not exceeding five per cent). Such cements will sustain a high temperature in the kiln and be benefited thereby.

If it becomes a question to decide which cement to choose, one containing an excess of clay or lime, we must unhesitatingly choose the latter. This is contrary to the prevailing belief, yet, if we accept the teachings of time, it must be conceded. The overclayed brands are at their best when fresh, while those containing an excess of lime require age to allow a thorough hydration of the free lime by exposure to bring out their best qualities. They will withstand the action of water equally as well as the overclayed brands, and for all masonry above water, or where subjected to water and air alternately, are infinitely superior. If properly hydrated, such cements will sustain immediate immersion even better than the overclayed brands, and will test equally as high, yet the fracture will show that crystalization has hardly set in at twenty-four hours, as they will yield readily to the knife, while the overclayed varieties show a much harder set, thus disproving the idea so prevalent that overlimed cements set quicker than the others.

The setting of a cement becomes slower as the proportion of lime is increased, until we pass up through the slow-setting hydraulic limes and arrive at the pure limes, where crystalization ceases. We must remember that that which causes a cement to set properly under water is also the cause of its comparatively-early disintegration when exposed to the atmosphere. A cement that carries so much lime as to require from three to six months to harden in exposed masonry will be found in perfect condition ages after the mortar made from quick-setting cements has crumbled out and disappeared.

The Aberthan hydraulic lime, consisting of 81.16 per cent of lime and 18.84 per cent of clay, the lime containing 62 per cent of silicate of lime and 38 per cent of free or caustic lime, was used in the construction of the Eddystone Light-house in 1757. It was so slow in setting that the engineer, Mr. John Smeaton, of England, covered the joints with plaster-of-Paris to protect them from the sea until the mortar hardened. This light-house stood in perfect condition over one hundred years, and until taken down to make way for a larger one. The hydraulic lime of Teil, in France, the composition of which is substantially the same as the Aberthan lime, has been in use in the form of concrete, made into blocks for sea-walls, for the past fifty-five years without showing any signs of disintegration. Neither of these limes can be made to test ten pounds in twenty-four hours if given but one hour in air, and they would stand a poor show in this country, where quality is gauged by the testing-machine. We have in the United States inexhaustible beds of hydraulic limestone, equal in every respect to those just mentioned, which probably will be utilized to only a limited extent so long as the present conditions as regards high tests exists.

Any coloring matter is an adulteration; the amount usually found, however, is of slight importance. A dark cement may or may not be a good one. A prejudice in favor of any particular color disappears when we come to learn that a really-perfect cement would be white.

Portland cement has not been in use in this country long enough to earn the position it now occupies, but, owing to some peculiarity in its molecular construction, it will test higher than our American cements, and will get harder, yet hardness is no evidence of durability. With equal exposure, a flint-stone will disintegrate much more rapidly than a soft, magnesian limestone. But the demand at present is for high test, and he would be a rash man indeed who would dare to stand against it. The manufacturers of a first-class American cement, looking back over the marvellous engineering works of the past, which have consumed upwards of seventy-five million barrels of natural cement, all manufactured in this country, and none requiring renewal on account of the poor quality of the cement used, are yet daily reminded that their cement is only a cheap article.

The testing-machine is a good thing if put to a legitimate use. It is the abuse of it that we object to. It should occupy a subordinate place. The understanding of the proper use of the machine consists

in knowing something of the chemistry of a cement, in knowing what a table of analysis means, in having a knowledge of true combining proportions, and of the effect of variations therefrom. Then the testing-machine becomes a valuable auxiliary, for its readings have taken on a new meaning.

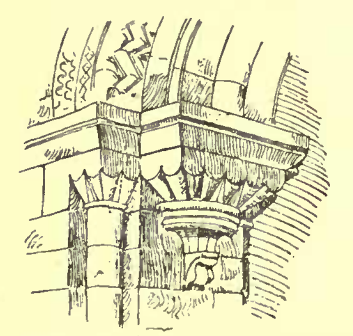
A study of the tables of long-time tests of Portland cements, as compiled by such engineers as Clarke of Boston and MacClay of New York and others eminent in the profession, reveals the fact that briquettes of neat Portland cement do not test as high at three or four years as they do at one or two years old. I have seen works that were made with Portland-cement concrete remain in perfect condition for eight years, and during the ninth year go all to pieces. The ten-year tests of Portland cement made by Dr. Michaelis, of Berlin, show that the maximum strength was reached at the end of two years, and this point held fairly well until the end of the seventh year, but from that time until the end of the tenth year, there was a remarkable falling-off in values.

During the past summer, the engineer in charge of the Aberdeen harbor sea-works, reported a serious failure in the Portland-cement concrete works at that point. After only fifteen years' immersion it went to pieces, while the natural-cement concrete, at the same place and the same age, was in good condition. After a thorough examination by a Board of engineers, assisted by Professor Brazier of Aberdeen University, it was concluded that "Portland cement cannot resist the action of sea-water." Another case is that at the harbor of Dundee, reported upon during the past summer. In this instance the Portland-cement concrete had softened in sea-water and natural cement was used to protect it, if possible, from further disaster.

Comparing these things with the splendid record made by the natural cements used under similar circumstances, that have successfully withstood the chemical action of the sea-water for over half a century, we are led to the conclusion that man has not yet succeeded in compounding the materials essential to the production of a first-class cement that can surpass in durability that which nature has so bountifully bestowed upon us.

An interesting and lengthy discussion followed the reading of the paper, after which the meeting adjourned, with a vote of thanks to the speaker. LOUIS FAUNCE, *Secretary.*

STEAM FOR EXTINGUISHING FIRES.



WHALPLODE CHURCH, LINCOLNSHIRE.
AFTER THE BUILDING NEWS.

THE timbering in the Calumet and Hecla Mine in the western portion of the Lake Superior district in the United States, recently caught fire, and burnt so fiercely that it defied all attempts at extinguishment, driving the miners to the surface. Progress in extinguishing the fire was made later by using a four-inch steam-pipe extending into the mine, as a means of discharging immense quantities of steam, at the same time closing up all openings to the surface. In addition to this, a large amount of carbonic-acid gas is forced into the mines; 25,000 pounds of sulphuric acid, and an equal amount of bicarbonate of soda are daily used for the purpose. At the time of writing, the fire has not yet been extinguished, although it is believed to have been very much diminished, and probably has not spread any further; but the after questions following the extinguishing of the fire will require the most enlightened engineering ability. First, the irrespirable gases must be systematically displaced by air before the mine will be habitable; and then after the people can obtain access to the mine, the measures which must be taken in regard to replacing the weakened or falling timbers by others, in order to avoid accidents from falling mine roofs, will require the utmost consideration. This mine, as is well known, is the largest in the world, having a very strong position, especially in the United States, in regard to the output of copper on the market, as well as prices, which the system of protective tariff virtually abets. Many years ago the use of steam was frequently assumed to be of great importance in the extinguishing of fires, and many American textile mills were provided with steam-pipes reaching from the boilers to the various rooms; but the results obtained from such apparatus did not justify the expectations which were anticipated from their service at time of fire, for reasons entirely outside of the value of steam in extinguishing the fire, by displacing the air which supports combustion; because many of the American mills were run by water-power, using steam for heating the mill during winter, and also, in slight quantity, for sizing, drying and dyeing during the whole year. But there would not be sufficient steam capacity, even if the pipes were of ample dimensions to deliver the required amount of steam in the short time necessary for efficient service; and when such apparatus was put to trial, under the best of circumstances it was found that the influx of steam-pressure would break out the windows, if the room was not so open as to allow its ready passage through elevator-wells, stairways, belt-holes and other parts of the building, so that as a practical result, the steam would operate rather as a steam-blast than as a fire-extinguisher. In the American oil-refineries, steam-jets are used for fire-apparatus, and generally with satisfactory results, because the plant is wisely laid out for such purposes, using boilers constantly kept for such service, with high steam-pressure and pipes of size ample to discharge an immense volume of steam into any one room, and even to keep the room full of steam, notwithstanding the various openings which may exist at the time through accident or other cause. The principle of the automatic-sprinklers which are in universal use in American mills has been used in connection with steam-jets in places where the use of water would be attended with excessive damage, as in tobacco warehouses and manufactories, where the automatic-sprinkler, instead of being secured to tees in the pipe hung pendant in the usual manner, are placed in the ends of pipes nearly one foot long, leading down from the main pipe. These short pipes are filled with water by pumping water through the whole system and then drawing it off, leaving it in the other smaller pipes; then steam is forced into the system, keeping the main pipes full of steam, but protecting the automatic-sprinklers from fusion by the steam heat by means of the interposing column of water in these short pipes. This modification of the well-known sprinkler apparatus has been put to successful use in an experimental manner, although it has not yet been subjected to the test of fire starting from accidental causes. On the other hand, steam is known to have been a cause of producing fires, not in reference to the formerly mooted question as to whether steam-pipes could produce fires by contact with the combustible substances, but the actual operation of the cause of fire by the use of the steam as a dynamic force rather than from its temperature. An instance of this kind happened in a large cordage establishment, where the hemp was sprinkled with an emulsion of whale-oil in the usual manner before treatment by the preparatory process. A large steam-pipe, some six inches in diameter, broke, the end falling into an iron tank of whale-oil, which had been presumed to be guarded against any accident which could possibly be foreseen, and the great volume of steam vaporized the oil, sending it through the building and outward into a passage-way, where it was ignited by contact with the fires under the boilers in the boiler-house, and at once spread throughout the mill. A very curious mishap occurred at this fire, because those fighting the fire noticed that there was no evidence of operation on the part of the automatic-sprinklers, and one of the workmen suddenly rushed to the valve-house in the vicinity of the building, and let the water on the sprinklers. The subject was investigated, and revealed the fact that at the time of the fire men were engaged in increasing the automatic-sprinkler plant so as to cover an extension of the mill which was just finished, and the pipes were in position, but not attached to the old pipes, and for the purpose of so doing the water had been shut off and the caps at the end of the old pipes removed for the purpose of attaching the couplings connecting the new pipes with the old system. — *Engineering.*

NOTES AND CLIPPINGS

THE SURAM TUNNEL. — A letter from a correspondent at Suram, addressed to the *Novoe Vremya*, effectually disposes of the rumor that has circulated repeatedly of late in the American press, denying that Russia had seriously taken in hand the construction of a tunnel through the ridge of the Lesser Caucasus, between Batoum and Tiflis. According to this correspondent, fair progress has already been made at one end of the tunnel, the excavation having already penetrated over 1000 ft., while at the other 200 ft. of rock have been cut away. The boring machines are of the latest description, and every improvement in tunnelling is being adopted. The total length of the tunnel will be 2 miles 300 yards, and it is expected that it will be finished by the end of next year. The cost, with that of the loop-line, will exceed 1,000,000*l*. The tunnel at one part passes through clay and will require to be lined with stone, but a good deal consists of solid rock, which requires to be blasted by dynamite. Pending the construction of the new line, the traffic over the Suram Pass still continues in a very congested condition, the two 72-ton Fairlie engines being able, owing to the heavy gradient, to haul only eight or nine trucks over the pass at a time. To relieve the congestion the Government has sanctioned the laying of kerosene pipe-lines, 37 miles long, over the pass. Messrs. Nobel and Rothschild have already received permission to lay down pipe-lines of their own, and other competitors are in the field. When the final concessions are signed by the Government very little time will be needed to manufacture and lay down these lines; Messrs. A. and J. Stewart, of Glasgow, for instance, who supplied 55 miles of pipe-line for the Suakin-Berber Railway at the rate of a mile a day, being able to execute such a pipe-line in about three weeks, and a few weeks more would be sufficient to lay it down and get it in working order. — *Engineering.*

PORPHYRY QUARRIES IN EGYPT. — Egyptian porphyry has been sought after from the earliest times as one of the most precious building stones. Ancient writers differ as to the whereabouts of the quarries from which that stone was obtained, and in modern times they were literally rediscovered by Burton and Wilkinson in 1823, and subsequently visited by Lepsius in 1845. The information published by these visitors proving of no immediately practical value, Mr. W. Brindley determined to follow in the footsteps of Wilkinson, and in a paper, of which an abstract is published in *Nature*, gives an account of his visit. Having examined the ancient granite quarries at the first cataract, which supplied deep red, rose and dark gray stone, which was quarried by metal wedges, and not wood (as is generally supposed), the author

started from Keneh with a small caravan and supplies calculated to last three weeks. Passing the remains of several Roman stations the author, on the fifth day, reached an excellent well in the charming Wadi Kitar, hemmed-in on three sides by precipitous mountains. Soon after leaving this valley he crossed the water-shed (2400 feet above the Nile), and then travelled along the flank of the immense porphyry mountain of Gebel Dukhan as far as the old Roman station with an old fort. The morning after his arrival the author ascended to the top of a pass (3100 feet) without having found even a fragment of porphyry; but espying by the aid of a good field-glass porphyry coloring on the opposite mountain he resolved to go there, and his delight knew no bounds when he found the ground there strewn with pieces of the most sumptuous porphyry, and discovered a pitched way or slide, 16 feet wide, down which the blocks were lowered. Further examination led him to the locality where the Romans had extracted their grandest masses, and he found that these quarries had yielded not only the usual spotted variety, but also the brecciated sorts and green-grays. The great quarry was at an altitude of 3650 feet above the sea, and a road led down from it to an ancient town with workshops. A path led hence to the old town in the valley, farther up which are the ruins of a Roman temple. The blocks were formerly carried to the Nile, a distance of 96 miles, but they will in future be conveyed by a gentle incline to the Red Sea, which is about 25 miles distant. On his return to Cairo the author secured a concession to rework the quarries, the terms of which have been ratified.

Steel used for Roofing. — Roofs of great span are not uncommon in England. Till the construction of the iron roof over the Olympia at Addison road, St. Pancras-station roof, which has a span of 239 feet, held the reputation of being the greatest. But these roofs are to be exceeded by one designed in connection with the Machinery Palace being erected for the French Exhibition of 1889. The project of a machinery gallery was decided upon in May last, and the work was submitted to contract. M. Dutort is the architect of the machinery palace, and, with the aid of MM. Contamin, Charlton, and Pierron, the details of the metallic pieces have been arranged. The gallery is constructed entirely of steel — the first great exemplification of the value of steel for structural purposes of this kind — and when finished the structure will embody the progressive developments made in the art of the engineer. The gallery will be of rectangular shape in plan, having a length of 1,387 feet and a width of 492 feet, or an area of 672,401 square feet. The main span will be 362 feet clear of tie-rods. Each truss forms a four-centered arch of bold springing curvature, and will consist of two half-arches resting at their bases and apices upon pivots. Each rib is on the open lattice principle, with long and short panels. These are connected by vertical purlins, four on each side of the apex. The maximum height from the ground to the upper pivot is 147.5 feet, which height would allow the Vendome column to stand beneath. Open spandrel pieces of iron fill up the ribs at the haunches, by which the roof covering is continued straight to the outer guttering. There are nineteen bays. The central bay is seventy-six feet, and the other seventy feet each in width, and the end ones each eighty-three feet. Projecting pavilions roofed on a lower level abut against the central hall, thus adding greatly to the total superficial area. By the employment of steel, M. Contamin and his colleagues have been able to obtain strength with extreme lightness, so that the trusses will not exceed twenty-four pounds per square foot. If this be so, the gallery will possess the lightest metallic roof of any exhibition. The former exhibition had metallic frameworks, weighing from thirty pounds to thirty-four pounds to the square foot. Though it is not safe to compare structures of different design, it would appear the experiment at the machinery palace of the Paris Exhibition of 1889 will confirm the opinion of engineers that steel can be used for roofing with economic results that cannot be obtained in iron. — *Industrial World.*

Old Italian Castles. — The ruined castles and the numerous relics of the past which are found on the mountain summits of the Apennines bear testimony in their decay, not so much to the strength and skill of the repeated attacks to which they were exposed (for in many cases they were impregnable before the invention of artillery), but, unfortunately, to the neglect of their owners, arising mainly from the reverses which the great families from time to time experienced. Most of the illustrious Italian houses were connected with trade; this was a characteristic of the great republic; at least one member of each family was enrolled in some guild or mercantile corporation. This connection with trade in no degree diminished the refinement of taste or the love of the beautiful of the most illustrious of the Florentines. On the contrary, the merchant princes, with the richest products of other climes, gained much experience and art knowledge, which found their expression in the noble works and the adornment of their cities. But there was one evil result of this association of nobility of race and commercial pursuits, that it rendered their prosperity very precarious; the frequent revolutions in the Italian republics arose as much from commercial as from military causes. The middle of the fourteenth century was especially a period of great speculation and of much suffering to many of the most illustrious houses — the Bardi, the Anciaioli, the Mozzi, the Peruzzi, were all struck down. — *Blackwood's Magazine.*

Swiss Families. — Since the application of the Code Napoléon to Switzerland, families may be regarded roughly as joint-stock companies, managed by the parents for the common benefit. It is known that when both parents die, the estate will be divided into equal portions among the children, boys and girls sharing alike. All money, therefore, which is drawn from the estate by sons and daughters for extraordinary purposes is debited against them. If a boy, for instance, elects to be a doctor, he anticipates his share in the eventual division. All labor expended by them on the estate is reckoned to their credit. If a boy stays at home and works like a farm servant, he acquires a future claim in proportion to his service rendered. It is for the interest of each member to pay off debts upon the property or to increase its value. Consequently, when a son goes out into the world, after his education has been completed, it is expected of him to remit a portion of his earnings to the family fund. This stands in lieu of work he might have done at home and also as a recognition of his early rearing. The precise amount to be thus contributed by individuals is determined by feeling and instinct more than by any fixed rule. The system cannot have the exactitude of a mercantile concern, yet it approximates to that standard. The result is that both sons and daughters in a Swiss family feel it their duty either to discharge personal functions in the home or else to send a part of their gains yearly back to the common stock. — *Cornhill Magazine.*

TRADE SURVEYS

The fact that $145,000,000 of foreign capital has been invested in American railway securities in one way or another within the past six months is one of those hidden sources of strength that is helping to cause a reaction in railway circles with reference to next year's railway building. The demand for railway securities in London and other foreign centres has caused an advance, and the reaction on this side is having an excellent effect. Foreign buyers and lenders of money are showing more confidence in American railway management, a result which is largely due to the workings of the inter-State commerce law, and the creditable desire manifested by railway managers to honestly carry out its purposes. Railway managers are getting together East, West and South, to harmonize matters, and are meeting with encouraging success. The effect of this improvement will be to encourage railway building enterprises, which received a little set-back two months ago. Arrangements are being made by the Northern Pacific, the Central Pacific and the Canadian Pacific Companies to harmonize their business interests between Chicago and the Pacific Coast, with a view to lessen competition and to secure uniformity in traffic rates. The far Northwest is rapidly building up, and the fears which were entertained a few months ago relative to the revival of a disastrous railway war seem to be dissipated already. The Northern Pacific Railroad Company has just given an order for 2,000 freight cars, and needs 5,000. The trunk-line railroads between the Atlantic Coast and Chicago need 10,000 more cars than they have for present requirements, and will place the orders as fast as the car-building capacity can take care of them. Facts like these deserve more than a passing notice, because of the meaning they have with reference to next year's operations. On the other hand, railroad building interests which would place orders for as much as half a million tons of rails, if prices were suitable, are still hanging back, declining to pay the prices asked, believing that their policy will force makers to accept $30 or $31. Three rail mills have temporarily shut down, and other mills will do the same rather than accept anything under $32. Several new railroad building enterprises will be brought to the attention of financiers in New York and Boston during December and January, with a view to the development of a large section of country between Missouri and Mexico. The anthracite coal trade is extraordinarily active. The production at this time is about 125,000 tons per day. The production will be about 34,000,000 tons for the year. At present the excess over this time last year is 2,250,000 tons in round figures. The Pennsylvania Railroad Company is carrying 52,000 tons of coal and coke per day over its lines. The Reading Company is averaging 165,000 tons of anthracite. The Cumberland lines are averaging 80,000 tons per week. The production of bituminous and anthracite coal is far ahead of anything ever known. The shutting-down of navigation will throw large quantities, now going West, into Eastern markets, and ease up the excited condition which the anthracite strike has maintained for six weeks past. The strike will probably be a failure, although the miners are more determined at this time on account of the assistance so freely tendered them. The lumber trade is no exception to the general activity. The great demand for all kinds of lumber is stimulating speculation. One operator has just purchased sixty million feet of pine land in the Duluth district. Large parties have closed contracts for about one hundred million feet of logs during the past week in the Northwest. Larger and heavier contracts than usual are being closed in the South for Western and Northern shipment. Southern lumber manufacturers have been crowding capacity very rapidly, and thirty million feet of stock are now awaiting shipment at Pensacola. The cut of lumber this season in the upper Mississippi district, of which Minneapolis is the centre, is 262,000,000; of shingles, 81,000,000; and of lath, 55,000,000. Over 100 million feet of logs are in readiness for next spring's sawing. There is a boom in saw-mill building and improvements in that region. The lumber manufacturing activity in the South is largely due to the building-up of industries. In Birmingham alone 2,000 houses have been built. Saw-mills are springing up, and saw-mill machinery is being ordered faster than ever before known. The present upward tendency in prices is phenomenal. It has come at a time when least expected. Capacity of every kind has been expanding steadily for two years, and instead of lower prices we find wheat, corn, cotton, sugar, petroleum, copper, lead, tin, and even some kinds of iron and steel, higher than for months past. Naturally, a reaction is looked for. The basis of this improvement may be legitimate enough, and to all appearances it is, but an upward tendency generally reacts, because of the stimulus it gives to productive capacity. One class of thinkers attribute this rapid growth to the opportunities afforded enterprise by an increase in the volume of money. No doubt this fact has much to do with the present healthful condition of trade. More money generally means higher values, and higher values often disarrange the great factors of trade, and necessitate a reorganization, frequently through bankruptcy more or less general. It is useless, however, to borrow trouble on this score. The country is making rapid strides. We cannot measure our conduct altogether by old rules or old standards. Everything is unusual and phenomenal. The wisest predictions of financiers and builders have repeatedly proved false. The real capacity of the country is not understood. There are greater opportunities than the most sanguine anticipate. The panics which have overtaken us every few years in the past, are looked for in the future, but the causes which have brought them about may not recur, and wisdom which is born of experience, is enabling us to so regulate our affairs to make their recurrence less probable. Nothing would sooner bring about a reaction than a scarcity of money, just as a scarcity of rolling-stock would very soon interfere with the easy transaction of the business of a railroad. The West and South is rapidly filling up. Land is still advancing in value in certain localities. The real-estate value of the entire West has improved, and even should a depression overtake the country, much of it will retain its present value, because it is held by strong parties who can afford to wait for another rising tide.

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CONTENTS

THE *Sanitary News* gives a report of a discussion which took place at a recent meeting of the Illinois State Association of Architects on the subject of the union of all the existing professional societies. While several speakers maintained the importance of such a union, Mr. Normand S. Patton, in a very clever paper, presented the opposite view, holding that an association of architects must be mainly for social purposes; that there were no questions of general interest for a national body to consider, and that even matters of professional ethics, which might have a certain general importance, were far better regulated in small societies by the influence of mutual acquaintance and regard than by the decrees of a far-off tribunal, which could not be carried into effect without great trouble. In his opinion, the local influence of a society could not be made to extend more than about five hundred miles from the seat of its principal activity, and the establishment of three main associations, each controlling a territory a thousand miles wide, would be more favorable to the interest of architects and architecture than the maintenance of one gigantic, but imperfectly nourished organization. In the discussion which followed, Mr. Patton explained that he favored the establishment of a national organization, if this could be carried on without giving up existing societies; and most of the speakers seemed to agree with this view, many of them, however, suggesting various matters which could be better left to a national body than to the local ones, among these being the establishment of rules for professional conduct, for the management of competitions, and so on, as well as the protection of members in disputes involving questions of general interest to the profession.

THIS last suggestion, which was made by Mr. L. H. Sullivan, seems to us to contain the germ of great possibilities for the proposed national society. Probably most architects think that some sort of federal organization is desirable for a national body. There are isolated cases where architects may with advantage be elected directly by the central association, but experience has shown the great advantage of having most of the members enter the association from the local societies, which know all about the character of their own members, and, as a rule, keep a salutary control over their professional conduct. The principal difficulty about such an organization has been hitherto, as it seems to us, the absence of any great advantage of membership in the general body over that which those enjoyed who simply belonged to the local organization. If the members of a national body, chosen or nominated by the local societies, or, perhaps, holding a place in the national society by the fact of connection with a local body, were alone eligible to some important and profitable position, or enjoyed exclusively some other valuable privileges, there would be no difficulty in filling the ranks of the central as well as the local bodies. Perhaps later, in connection with Government commissions, some such recognition may be given here, as in France, to the members of a body representing the best and most honorable professional work, to the great advantage of the public and of art, but at present the most tangible advantage which a national organization can offer to architects as individuals is, perhaps, the promise of support in their struggles for justice with the people who try to impose upon them. We are persuaded that if architects, after their first ten years of practice, would look back and count up the "discounts for cash" which they have had to make from their bills, the compromises, bad debts and open frauds, the hours spent in making plans abandoned and never paid for, the barefaced swindles perpetrated upon them in the guise of competitions, and the losing bargains into which they have been entrapped on various pretexts, they would be amazed at the result. Judging from our experience, there are few architects who have been ten years in practice, who are not ten thousand dollars poorer than if they had experienced such treatment during that time as the profession considers itself fairly entitled to, and a very large part of this sum would represent the money value of connection with an alert and powerful organization, quick to take up the defence of its members against wrong, and armed with the authority of a great representative body, as well as experience and skill in managing such cases. As a rule, no action on the part of the central body would really be needed. The consciousness of support would give the younger members courage to persist in rightful demands, and refuse compromises or concessions, and if this failed, an admonition from the central body would generally bring the adversary to terms, so that actual cases carried on by the association on behalf of members would be much rarer than they are now between individual architects and other persons, and the cost of protection need not be very large. It would be desirable, on all accounts, to confine the employment of such defence to members of the national body, for the reason that, if properly chosen, their good faith could be depended upon, and, if judiciously managed, the support so afforded would be so valuable as to draw all the better part of the profession into the local societies, and through these, into the necessary relation with the national body.

THE *Sanitary News* quotes some very singular observations from Mr. J. S. Haldane, who has made many analyses of air in England, the results of which are in startling contrast with the common notions on the subject. Some of Mr. Haldane's most important tests were made on air taken from sewers, and this air was found, so far as analysis could discover, to be actually purer than the atmosphere outside. The sewers of the city of Bristol, for instance, are almost wholly unventilated. There are only two places of access to the system, and the air, when Mr. Haldane visited them to make his analysis, was much warmer than that outside, from the effect of the prolonged action of the warm sewage in a confined space. Yet the air of this sewer, taken as far as practicable from the opening, showed only about twenty volumes of carbonic acid in ten thousand, a smaller proportion than in average schoolrooms, while in "bacteria" and organic germs, which have now rather superseded carbonic acid as atmospheric bugbears, the sewer air was far purer than that of the streets outside, the average in the unmixed sewer air being two to the litre, while air taken outside at the same time averaged thirteen per litre. The same results were obtained in other cases, so that, as Mr. Haldane says, instead of sewer air being "loaded" with microbes, as is commonly believed, it is the outside air, which, when it is allowed to get in, contaminates the sewer atmosphere, the latter being, chemically speaking, exceptionally pure. It is, of course, not impossible that the sewer-microbes may be more venomous than the ordinary sort, but there is no positive evidence of this, and the indications are that they are nothing more or less than those of the exterior air, which have been drawn in somewhere, and not yet eliminated by the natural process of coming in contact, in their flight, with the moist walls of the sewer, or the surface of the stream, and sticking there. So unanswerable do these conclusions appear to the editor of the *Sanitary News* that he can see no way of accounting for the entrance of bacteria from sewage into houses through leaky pipes except by supposing that where this occurs, if it ever does occur, some liquid sewage must have splashed through the openings, and have dried on the outside, coming thus into

a suitable condition for being taken up as dust and disseminated through the air of the room. As sewer-pipes almost always corrode first on the upper side, where liquids seldom or never come in contact with them, it would be rather a violent assumption to suppose that the bad effect of a leak could only be due to the passage of liquids through it, and even this would fail entirely in accounting for the transmission of typhoid-fever infection, as is said to have happened at Croydon, through the sewers from the lower portions of the town to the higher parts. The fact is that, as the *Sanitary News* well observes, our knowledge of the subject of infections is very limited. Not long ago, many physicians doubted the existence of such a thing as infection, and attributed epidemics to "atmospheric influences," "periodical tendencies," and so on. A little later, perhaps more particularly after Pasteur's famous researches, specific infections were reëstablished as real objects of scientific study, and, as hardly a week passed without the announcement of the discovery of a new microbe, the world began to multiply, instead of diminishing, the number of infectious diseases, and to see noxious germs everywhere, in the air, the water and the earth. What will be the next step it is impossible to say. No student of sanitation can have failed for some time past to observe the existence of the beginning of discontent among sensible people, with the theories which accused bacteria of being the cause of all our woes. As many of the so-called specific microbes of disease are indistinguishable from others which swarm in healthy persons, and as myriads of all sorts float constantly in the air, it is not strange that people should ask themselves how it is possible to escape contagion conveyed in that way, and there will be a certain relief in finding that the source of infection is still one of the unsolved mysteries of life.

A PAPER was read at the recent meeting of the British Association for the Advancement of Science, by Mr. W. Brindley, who is, we suppose, connected with the great firm of Farmer & Brindley, workers in marble and ornamental stones, upon the rediscovery of the ancient porphyry quarries of Egypt. It is well known that the Egyptian porphyry, a very hard stone of a purple red color, generally speckled with white crystals of felspar, was valued by the Romans more highly than any other building stone, and was used by them not only for shafts of columns, but for statuary, vases and other small objects. The ancient writers agree in saying that the quarries from which porphyry was derived were situated in Egypt, but, although two or three travellers had searched for them, no one had given satisfactory proof of his success in finding them, and, as Mr. Brindley learned, the samples of stone brought by various explorers from the quarries they had visited were of different character from the real antique porphyry. In February of this year Mr. Brindley, with his wife, started on an expedition in search of the precious deposit. Of course, this would be found, if anywhere, in the mountains of granite and other primitive rock which lie between Thebes and the Red Sea, and to this place the party proceeded. After a visit to the famous granite quarries at Syene, Mr. Brindley returned to Kiné, a village on the Nile below Thebes, from which a practicable, but little-known path crosses the mountains to the Red Sea, and there formed his caravan for the trip, consisting of fifteen camels, attended by nineteen servants, and loaded with provisions, water and other necessaries for a three-weeks' journey. On the second day the camp was pitched at an ancient Roman station, showing remains of fortification; and some bits of real porphyry were found in the sand. The next day a similar station was reached; and on the third day another, near which were passed several porphyry blocks, and a portion of a column, all buried in the sand. The path now entered a rocky pass, through mountains five or six thousand feet high, each day's journey being marked by the ruins of a fortified Roman station, with either a well or the remains of cisterns, this having been, just before the Christian era, a portion of the main caravan route connecting the Roman system of roads in the Nile valley, and by it all Western Europe, with the Red Sea and India, but no more porphyry was found, and Mr. Brindley began to fear that he had missed the object of his search. On reaching the summit of the pass, therefore, he paused, to take a more extensive view, and saw, looking eastward, that the path descending from the pass toward the Red Sea divided, about half-way down, one branch going toward the ruins of a considerable town, which were visible in the plain, while the other branch diverged across the valley toward a mountain which, when examined through a field-glass, showed the purplish hue of porphyry. Starting immediately down the path in that direction, he soon came to the foot of the purple mountain, where, to his great satisfaction, he found the sand strewn with bits of porphyry, while near by stood the piers to support the slide by which the blocks were sent down from the quarry above. The path to the quarry itself had once been excellent, but was now interrupted in places by gullies, so that there was some difficulty in reaching the place where the ruins of a number of workmen's huts, together with a steep face of rock, in admirable condition for cutting, indicated that here the main quarry was situated. Instead of porphyry, however, the rock appeared to be a dull, yellowish stone, of no value, and Mr. Brindley concluded that this must have been merely the matrix of the fine veins of porphyry. While looking for these veins, however, he observed that the vertical face of the yellow rock was full of drill-holes, and, wishing to learn for what purpose it could have been used, he knocked off a piece with a hammer. To his surprise, the broken surface showed the color of the finest porphyry, and after breaking off more specimens, he found that the whole ledge was of the same sort, superficially covered with a film of ochre which had washed out of the rocks above. After satisfying himself that this was unquestionably the long-lost Roman quarry, he retraced his steps, passing on the way a ruined temple, with an inscription invoking the favor of Serapis upon the Emperor Hadrian, and commemorating the loyalty of a certain Epaphroditus Sigerianus, the superintendent of the quarries; and, returning to Cairo, secured from the Egyptian Government a concession for reopening the quarries, which are likely now to be scientifically worked.

THE new process for covering iron and steel with an unchangeable coating, by means of electricity, discovered by M. de Méritens, and mentioned last year, is now fully described in *Le Génie Civil.* Nearly all the processes for protecting iron so far used have consisted in the production on the surface of a film of magnetic oxide, which is permanent and unchangeable. The old methods of browning or bronzing gun-barrels accomplished this result very imperfectly by corroding the outside of the barrel with acid fumes or washes, so as to cover it with the ordinary red iron-rust, or sesquioxide. The gun was then rubbed with iron turnings, or a wire brush, by which particles of metal, in fine division, were scattered among those of the sesquioxide, and a partial combination effected, by which the higher oxide was reduced to the condition of magnetic oxide. To obtain a durable film, the operations of corroding and rubbing down were often repeated twenty or thirty times, and even then the protection was far from complete. Some years ago Messrs. Bower and Barff discovered independently two different methods of coating iron directly with magnetic oxide, one using for the purpose a bath of hot-air, while the other employed superheated steam. Each patented his process, and the two interests were afterwards united, and companies formed to carry on the business of covering objects of iron with the protecting film, by the medium of either air or steam, as might be most convenient, under the general name of the Bower-Barff process. Under the skilful manipulation of M. de Méritens the ordinary electro-plating bath is now made to deposit on iron a film of magnetite which is said to be even more uniform and adherent than that formed by the older processes, while the apparatus required is far less costly. To form the coating, the object to be protected is placed in a bath of distilled or other pure water, and is connected with the battery or dynamo as anode. The cathode may be a piece of copper, iron, or carbon; or, if the vessel containing the bath is of iron, it may itself be the cathode. The bath should be heated to about one hundred and eighty degrees Fahrenheit, and the currents must be weak, having just electromotive force enough to decompose water, after overcoming the resistance of the circuit and the bath. A few minutes after placing them in the bath, the objects to be protected, which should first be polished, begin to become black, from the formation of magnetite upon them; and in an hour or two the film is thick enough for service, and may be polished. The magnetite not only adheres with great tenacity, but seems to penetrate deeply into the pores of the metal; for after rubbing off with emery every vestige of a coating once formed, the object is almost instantly covered again, on replacing it in the bath.

TECHNICAL SCHOOL BUILDING.



From Brussels, Belgium.

THIS is an age of specialists; and in no department of human industry and thought has this condition been made so manifest as in architecture, a profession at all times complex and many-sided in its nature, but made even more so by the constantly-multiplying demands of modern life, and by the tendency of individuals in the profession to devote their energies exclusively to the mastery and the education of a single department. That architecture on the whole is the gainer thereby there can be no reasonable doubt. The time was once, and not long since, when the architect was the autocrat and was assumed to be past-master of every detail of design and execution. Now, the business necessities of the profession, no less than the artistic limitations which govern it, have given rise to the feeling that art is too long and time too fleeting for the individual to grasp everything; and whenever the general practitioner has the opportunity to avail himself of such excellent experience and research as is embodied in the recent work on School Buildings, by E. C. Robins,[1] he can not but feel how vastly the profession has been advanced by the continued, persistent efforts of men who claim to be at home in a single department of architecture, but who understand that department thoroughly.

Mr. Robins's work is, however, more than a mere treatise upon architecture as applied to school building. It is a book which will be invaluable to the educator, no less than to the architect. The first two chapters are devoted to the consideration of technical education in England and on the Continent, including a careful analysis of the reports of the Royal Commissioners on Technical Education, and discussing all the points involved in the organization of such schools as the Central Institution at South Kensington and the Conservatoire des Arts et Métiers at Paris. There are also two chapters on heating and ventilation, and a chapter on sanitary science in its relation to civil architecture, though neither subject is handled in a way to make the chapters of special value to the American student. It may be only an exaggerated national pride, but somehow it has always seemed to us that in view of our own advance in such matters during recent years, and considering the great climatic differences between this country and Europe, we can, after all, obtain from the trans-Atlantic authorities only general hints and suggestions in the departments of domestic and sanitary engineering. But, for that matter, the chief merit of Mr. Robins's book fortunately does not lie in the discussion of theories and systems, but rather in its presentation of facts, and right there the author's practical experience as an architect serves him in good stead, for he has been enabled to collect just the data, statistics and drawings which an architect would naturally turn to if called upon to solve any of the knotty problems involved in the planning of a chemical laboratory or the arrangement of an industrial school. In this respect the book is simply invaluable, as the greater portion of it is devoted to very complete descriptions of the plans, the arrangements and the internal fittings of the best science and art schools in England and on the Continent. The result is a mass of very well-digested facts arranged with a care and thoroughness which we might expect from some German professor or a French *savant*, but which would hardly be looked for from a busy man engaged in active architectural practice. Another advantage which the book offers is that nearly all of the data was collected personally by the author, and is, consequently, fresh, and in the main original. To use Mr. Robins's own words, "the author has striven to present to the scientific world the result of much study and travel, which he trusts may issue in the saving of much time and labor, and wasted energy, resulting from repeatedly going over the same ground; and also, by comparative analysis of the best examples, aid in the development of that discriminating power, without which the weaknesses of a design are as likely to be imitated as its strong points."

[1] "*Technical School and College Building*"; being a treatise on the design and construction of applied science and art buildings, and their suitable fittings and sanitation, with a chapter on technical education; by Edward Cookworthy Robins, F.S.A., F.R.I.B.A., etc. New York: D. Van Nostrand. London: Whittaker & Co.

The book is so wide in its scope that only a few of the buildings it deals with can be noticed here.

The new chemical laboratories of the Academy of Sciences, Munich, is considered by Mr. Robins as one of the best examples of modern German work. The conditions under which the building was planned are of interest as being essentially such as ought to govern the arrangement of every well-regulated laboratory of this size. The conditions were (1) That the laboratory must accommodate from one hundred and fifty to two hundred workers. (2) It must be divided into two spacious parts, one for inorganic, and the other for organic chemistry, each to be under separate direction. (3) The director of each portion must have a private laboratory with the necessary extra rooms, the assistants to work in the large laboratories. (4) The main laboratories must be sufficiently spacious, so that smaller rooms for advanced students need not be provided, in order to promote the intercourse of the workers; corridors, as far as possible, to be avoided. (5) Living-rooms in connection with the building must be provided for the assistants and servants.

The building, as finally decided upon, is quite neatly arranged. There is desk-room for one hundred and sixty-eight students in the laboratories. The ground floor is for the organic, and the first floor — or what we would term the second floor — for the inorganic divisions. The central point of the separate large laboratories, of which there are two on each floor, is occupied by the big chimney, which is placed in the internal angle between the north and west wings, which are at right angles with each other. At the ends of both wings, on both floors, are the two large laboratories; and from the connecting corridors between them access is given to the subsidiary rooms. A hoist near the chimney communicates with the store-rooms. At the end of one wing are the living-rooms, etc., and at the end of the other wing are the two private laboratories, projecting in an L beyond the main wing, and connecting with the large lecture or class room. The entire arrangement will be readily understood by reference to the accompanying sketch-plan. The only criticism that Mr. Robins has to make is that the private laboratories and professors' rooms should have been more centrally placed, and more directly in contact with the main rooms, though this was rendered impossible on account of limitations in the site.

A plan presenting a much better general arrangement, though more faulty in detail, is that of the Berlin Physiological Institute, a plan which is quite architectural in its appearance, with well-defined axes, symmetrically-disposed wings and pavilions, a grand central entrance leading directly to a main lecture-hall, and a wide longitudinal corridor. The problem is much more complex here than in the first example noted, and it speaks well for the architect that so many requirements for laboratories, professors' rooms, vivisection quarters, large and small amphitheatres, libraries, etc., should be so well combined into a scheme which should be at once perfectly adapted to its purpose, and at the same time be treated in so purely architectural a manner. Mr. Robins speaks of it as a good example of the manner in which these buildings are constructed in Germany, with the aid of government grants, by architects appointed by government, and usually themselves professors of architecture in one or another of the technical colleges.

The new chemical laboratory of the Zurich Polytechnic School, opened in 1886, is considered the largest and most perfect institute for teaching pure and applied chemistry as yet erected. The plan consists essentially of a large central entrance and stairway flanked by long lines of small laboratories, class-rooms, professors'-studies, etc., with the four large laboratories projected from the main portion of the building at each end, forming a complete letter H in plan. This arrangement does not seem as satisfactory on paper as the Berlin School, and we would hardly agree with Mr. Robins as to its superlative excellence. One of the best features of the plan is the complete isolation of the laboratories and the manner in which each is enabled to have abundant cross-light and ventilation, though such a scheme necessarily involves a spreading out and an abundance of corridors which is not altogether desirable. Mr. Robins calls special attention to the details and fitting, on which a great deal of care and study was expended by the professors in charge of the department. Each beginner's place at the working benches, in the large rooms as well as in the smaller laboratories, is provided with two gas-taps, one water-tap, and one vacuum-tap. Over and above this each double bench has, at either side, a water-basin, with a special water-tap and waste-pipe. The benches are provided with a number of closets and drawers of different kinds, and a special flat, with a lead-lined receptacle below for solid refuse. In every window niche there is a draught place, with a slate bench, gas, water, vacuum and waste pipes. These evaporating niches are over three feet wide, and therefore large enough to take good-sized apparatus; they can be divided into two compartments by means of a central sliding window. The draught is produced, first, by double chimneys passing through every one of the window piers; secondly, by pressure in the room; thirdly, in case of need, by a special gas-jet lighted in the exit hole. There are two end holes on each side of the niche, one close to the top, and another near the bottom of the niche, the second hole being intended for introducing any pipes conveying noxious gases. The arrangements are altogether worked out so completely that no special "stink room" is required, since all rooms are adapted for carrying on all sorts of work without nuisance.

Turning from the Continental examples, Mr. Robins next considers in detail a number of the more recently constructed English

schools of similar character. He makes no invidious comparison, but if the buildings he cites are to be considered as types of the best the country has done in such lines, the English architects have never studied the problem in the exhaustive, comprehensive manner which marks the work of their German fellows. Three schools by Mr. Waterhouse are illustrated, which are in every respect satisfactory and hold their own in comparison with the Continental work. That the other buildings show less comparative success, may, however, be due less to the architects than to the condition of technical education itself in England, which has never been developed to the point it has reached in Germany; for although the English have sent their best men repeatedly to Germany to study the ways and means, and although volumes such as the one at present under consideration have been published by the dozen, the German higher schools still maintain their superiority, unwilling though English critics and educators may be to admit the fact. It goes without saying, however, that the English schools are, nevertheless, worthy of most careful study and comparison.

One of the neatest arrangements given is the plan of the new Physiological Laboratory at Oxford, worked out in detail by Dr. Burdon Sanderson, which Mr. Robins considers "not only the latest in point of time, but also in point of merit, since it is the outcome of the ripened experience of a remarkable man." This laboratory is intended partly for practical instruction and partly for experimental investigation. As the subject comprises three branches of study: 1. That of the mechanism of the animal body; 2. That of the chemical processes which are carried on in it; and 3. Physiological anatomy and biology, it is necessary to provide for each of these subjects. In the Oxford laboratory the rooms devoted to these divisions of the science are entirely distinct, and in each subject the two purposes of research and instruction are separately provided for. The sketch-plan illustrates the details of arrangement better than any description. It is compact, easy of access to all parts, and abundantly supplied with cross-light and ventilation, all very essential requisites of a building of such a description. It is of interest to note how really similar this plan is to that of the Munich Laboratory, the first example considered. The arrangement is practically the same in each case, so far as the main departments are concerned. In the Oxford building the rooms are more closely connected and work together better, but in the Munich laboratory the dark inner corner is avoided more skilfully, and the large rooms are more thoroughly cross-lighted and ventilated, so that there is really very little to choose between the two.

A plan which is worthy of more note than Mr. Robins gives to it, is that of the ground floor of the University College, Dundee. It is an entirely different arrangement from anything else presented in the volume, the main building forming three sides of a rectangle enclosing the two laboratories, the room for quantitative work being lighted apparently only from above. Where all the ventilation is forced, the fact that the inner laboratory has no outside air or light except from above, would present not the slightest difficulty in execution, whereas the compactness and immediate accessibility of all the rooms would render the plan a peculiarly good one for a crowded site and under certain conditions.

It will be noticed that nearly, if not quite all the examples illustrated by Mr. Robins, are physical or chemical laboratories. He has, however, descriptions of nearly all the purely technical or trades schools in Germany and England, but he appears to have rightly assumed that the problems involved in a laboratory were essentially the same in general statement as those in any industrial school, while at the same time they presented a complexity of detail which called for special study and explanation.

Mr. Robins cannot be too highly praised for the care he has bestowed upon the details of his work. His descriptions leave nothing to be desired, and without becoming in any degree prolix, he tells everything there is to be told which can be of interest to the architect or the professional reader. Details of fittings, floors, exhaust systems, water and gas supplies, sulphuretted-hydrogen closets, balance-rooms, machine-shops, besides the more general questions of systematic arrangement, are all clearly noted in every building brought under consideration. If one were disposed to be captious it might be said with reason that he has confined his attention too exclusively to English and German work, ignoring the best French work, apparently assuming that the Conservatoire des Arts et Métiers was the last word on the subject from France. But we can hardly find fault with so thorough and conscientious a writer, especially when he does this country and our pet institution the honor implied in the final statement that the best technical school in the world is the Massachusetts Institute of Technology.

The Cost of Portland Cement. — The Hamburg *Börsen Zeitung*, in discussing the question frequently raised of late, whether the present movement in Portland cement is transient or whether the prospect for the ensuing year is favorable, says: "Significant indications are given by the result of the public competition which took place in Posen on the 2d of this month for the large quantity of 85,000 normal tons. This cement was ordered for use on the royal fortifications, and is deliverable in the period from now to June, 1889. The tenders submitted by ten manufacturers are, on the average, after allowing for transport charges, thirteen per cent higher than those of June 2, obtained by the same department for 18,000 normal tons. Especially significant is the fact that the lowest tenders of November 2 are about twenty-three per cent above the lowest of June 2.—*London Times.*

AN INTERESTING HISTORICAL RELIC IN THE CITY OF MEXICO.

THE CHURCH OF SANTO DOMINGO.



It is not difficult to find historic buildings in the city of Mexico. Once become acquainted with the history of the country, and most of the buildings of its capital will be found to bear some relation to it. The Church of Santo Domingo, the ruined walls near it, the medical college across the street on one side, and even a part of the row of new buildings across the street on the other side, form a group of buildings of peculiar historic interest. Each building was more or less nearly connected with the acts which went to make up one of the darkest chapters of Mexican history. Within that group of buildings the Inquisition had its home, and from one of them went forth stern decrees, delivering certain unfortunate beings over to the "secular arm" for punishment, which was only an indirect method of condemning them to death, by strangulation generally, and in some rare cases by burning.

It is not strange that many hasty visitors should be misdirected in their efforts to see the sights of the Mexican capital. Several things conspire to bring about such a result. Unless a change has been made very recently, the city is not supplied with reliable guides for the benefit of tourists. Many there are who claim to be guides, and these "*mean* well, but they don't *know*." Then the Mexicans cultivate politeness at the expense of accuracy. When you ask a Mexican a question you invariably receive a very polite reply, since to his mind to disclaim knowledge of a subject would not be polite. He has no idea that you especially desire accurate information. He has never experienced such a desire himself, and is unable to conceive of it in others. He imagines that you ask questions merely for the sake of sociability, and he answers accordingly. It is scarcely necessary to hint that errors are likely to occur, furthermore, in the exchange of ideas between an American with only a slight knowledge of Spanish and a Mexican with a knowledge of English still more slight. Indeed, all things considered, it is a marvel that American tourists obtain *any* correct information in the City of Mexico, and the errors perpetuated in print concerning the Sister Republic are quite pardonable.

The Church of Santo Domingo was pointed out to me soon after my first arrival in the City of Mexico, as doubtless it has been pointed out to many others as the building in which the Inquisition held its secret trials. Subsequent visits to the locality, and a careful study of everything relating to the Inquisition in Mexico, revealed the fact that the Holy Office never occupied the *Church* of Santo Domingo, but upon its establishment in the country, in 1571, a small monastery, which had been temporarily occupied by the Dominicans, was placed at its disposal. This was rebuilt shortly afterwards, and upon the same site was built, in 1732 or thereabouts, the building now known as the Escuela de Medicina (Medical School). It was dedicated to its present use about the middle of this century. It is across the street, at the right of the church, as that building is approached from the front. It retains but few of the architectural features which it possessed when devoted to the business of extirpating heresy and punishing ecclesiastical crimes, excepting its massive corridors and dark passageways.

The church is by far the more attractive building. The eucalyptus trees in the plaza before it, hide the front from view until the visitor arrives within a few feet of the entrance. The façade is elaborately carved in the Churrigueresque style. The church is of stone, whitish in appearance in front, a dark red on the street side. Of course whitewash, plaster, and paint have been used upon it. Richly-carved stone walls have in more than one instance received this treatment in Mexico; and there may have been cause for the application of something of the kind in the case of Santo Domingo. Bullets may have flattened themselves against the front, and fires may have burned around it to blacken its walls; for there have been revolutions and insurrections in Mexico since this church was built in 1736 to take the place of buildings erected in 1575, and destroyed by floods in 1716; and the plaza in front of the church has been a favorite place for political executions. The church has a fine dome and lantern, and a single tower at one corner, the corresponding tower on the opposite corner never having been completed.

The interior of the church compares favorably with any in the city. It is finely proportioned, decorated in rather good taste, and possesses paintings of some merit by native artists.

Back of the church, and on the left side, are the ruined walls of the Dominican Monastery, which must have been an immense building and a comfortable home for the order of Saint Dominic (Santo Domingo.) It shared the fate of all monastic property in the Republic, which in 1859 and 1860 was confiscated by the government, gutted, secularized, and left in partial or total ruin. Land for a street was "condemned" along the west side of the church about that time, and further destruction went on; but, fortunately, a very pretty little chapel — that of the Rosario — was left standing. The new street was in a very rough condition until a few years ago, when some enterprising capitalist, overcoming the scruples so general in Mexico against occupying property robbed from the church by the infamous "Reform Laws," proceeded to erect dwelling-houses on both sides of it. Very shallow were the lots on the side towards the church. A narrow shop hugs the front of the church as if claiming its protection. Red bricks were used in the construction of this row of buildings, — a strange building material in Mexico. The effect of the new street would be marred by these brick buildings, were it not that through open doorways, glimpses are caught of quaint interiors and picturesque stairs. There is no knowing to what use the ingenious architects (for the modern Mexican architects *are* ingenious and eminently successful in blending the old with the new) have turned the buttresses and other exterior ornaments of Santo Domingo in the interior arrangements of these new buildings. The skill displayed on the opposite side of the new street leads to the suspicion that everything has been turned to good account.

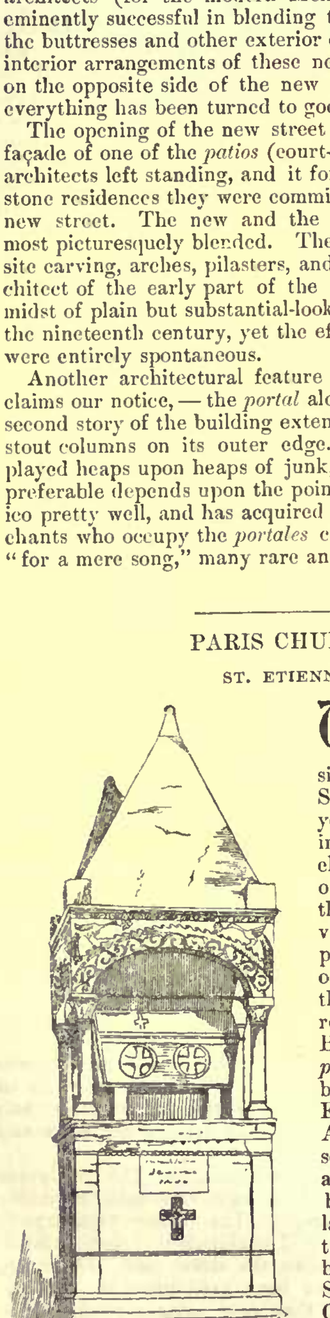
The opening of the new street laid bare the highly ornamented façade of one of the *patios* (court-yards) of the monastery. This the architects left standing, and it forms the front of one of the row of stone residences they were commissioned to erect on west side of the new street. The new and the old, the plain and the ornate, are most picturesquely blended. The handsome façade, with its exquisite carving, arches, pilasters, and balconies, all the work of an architect of the early part of the eighteenth century, stands in the midst of plain but substantial-looking buildings of the latter part of the nineteenth century, yet the effect is pleasing. It looks as if it were entirely spontaneous.

Another architectural feature of the vicinity of Santo Domingo claims our notice, — the *portal* along the west side of the *plaza*. The second story of the building extends over the sidewalk and rests upon stout columns on its outer edge. Between these columns are displayed heaps upon heaps of junk, — or *bric-a-brac*, — which name is preferable depends upon the point of view. One who knows Mexico pretty well, and has acquired the knack of dealing with the merchants who occupy the *portales* can often pick up in these places, "for a mere song," many rare and curious things.

ARTHUR HOWARD NOLL.

PARIS CHURCHES.[1] — VI.

ST. ETIENNE DU MONT.



TOMB OF THE FOSCHERARI, BOLOGNA.

UPON the summit of the "mountain" which rises up from the Seine opposite and on the south side of Notre Dame is the church of St. Etienne du Mont. Some few years ago the "mountain" was an interesting part of Paris to the archæological explorer and the collector of *bric-à-brac;* but it has been so cut through by new streets and boulevards that it has almost been improved out of existence. At the foot of it, in a little street turning off from the Quai de la Tourelle is all that remains of the famous college of the Bernardins, now used by the *sapeurs-pompiers*, or firemen. This celebrated college was founded by an Englishman, Stephen of Lexington, Abbot of Clairvaux, in 1244, upon some ground belonging to the rich abbey of St. Victor, Alphonse, the brother of St. Louis, being the titular founder and protector of the establishment. The great church, begun in 1338, to replace that of Stephen, by Pope Benedict XII and Cardinal Curti, was never finished, but was considered, in the fourteenth century, to be of great beauty. (Pope Benedict was, as Jacques Fournier, professor of theology in the college.) But more fortunate than the church, the refectory remained intact in all its beauty until our own time, though unfortunately in 1845 it was sadly mutilated in order to adapt it to use as a barrack. A portion of the cloister may still be seen in the street, a pointed arch built into the modern wall of a house with square windows in between. It is time the municipality of Paris, or the society for the preservation of ancient buildings bestirred itself to restore the few fragments of old Paris which yet remain. The Revolution did much damage; but it rather put the conventual buildings to secular uses than destroyed them altogether. It remained for later governments, and those, too, professing respect for religion, to utterly demolish the mutilated convents and churches in order to make straight streets and boulevards.

The convent of Ste. Geneviève was founded by Clovis, and so extensive were its lands and dependences that ere long it drew to it a large population of workmen and laborers. A priest was appointed to look after the spiritual wants of these, and from this commencement grew the parish of St. Etienne. Originally the congregation met and worshipped in the crypt of the abbey church, and their chapel was put under the protection of St. John the Evangelist, it being thence called St. Jean du Mont. But in the thirteenth century the congregation had outgrown its chapel, and in 1224 the Bishop of Paris authorized the building of a church by the side of the abbey, to be consecrated to the memory of St. Etienne, the protomartyr. This first church, in fact, formed a part of the abbey, as it had no separate entrance of its own — one could only enter it by the doorway of Ste. Geneviève. Three centuries later the same reasons (want of space), obliged the church to be rebuilt, and in 1517 it was commenced. Abbot Philippe Lebel finished the choir in 1537, and in 1541 the Bishop of Mégare consecrated the altars in the name of the Bishop of Paris. The *jubé* was commenced in 1600, the porches in 1609, and the chapel of the Blessed Virgin in 1661: the first stone of the great doorway was laid in 1610 by Marguerite de Valois, the first wife of Henri IV, and she added to the value of her work by contributing 3,000 livres to the building fund. Before the Revolution the *curé*, or rector, was one of the "regular" canons of Ste. Geneviève, who was assisted by twenty-four priests. In 1791, when the parishes of Paris were re-organized, it was determined to remove the relics of Ste. Geneviève to St. Etienne, and to rename the church after the maid of Nanterre; but the decree was never carried out — reforms and resolutions followed each other so rapidly that there was no time to put them into execution.

St. Etienne is a cruciform church (somewhat leaning to the right, as is so common in old churches), with a nave, two aisles and chapels. The transepts scarcely project beyond the nave. The exterior is a mass of elegant ornamentation, and on the north side, under the windows, is a passage which connects the porch of the second bay with the *charnier* — a sort of cloister built round the apse, exterior to the church. There is something extremely coquettish and fascinating about this church, with its high-pitched roof, springing from a Renaissance façade; and its fifteenth-century tower surmounted by a pepper-box lantern.

The old church of the abbey, which completely joined St. Etienne, has been swept away to make room for the Rue Clovis, but the refectory and the tower still form a part of the Lycée Henri IV.

The interior of St. Etienne is no less singular than the exterior. The side aisles are nearly as high as the nave and have enormous windows, which light the nave. The shafts which support the vault of the nave are of great height, and the bays are of the same elevation as the side aisles. Thus, where in most churches there is a triforium over the vault of the aisles, it is here open to the nave. Above these bays is a clerestory, the windows of which are as broad as they are high, with depressed pointed arches. In order to diminish the enormous height of the bays, the architect has conceived a device which I do not remember to have seen elsewhere. Half-way up, he has carried a sort of gallery of about a couple of feet wide, which goes the whole length of the church, encircling the massive columns, but broken at the transept. On the side of the nave, this gallery has an open, pilaster balustrade, and at the entrance of the choir it joins the *jubé*. On each side of this is a spiral staircase leading up first to the *jubé*, and then, a second flight to the choir-gallery. The former is formed of a single flying-arch, supported by two pilasters. The whole screen is ornamented with rich carving, an angel with palm-leaves is in each spandrel, and above all is a huge crucifix, completing this beautiful and original specimen of French Renaissance. The pendant bosses of the nave and crossing are exceedingly rich in ornament — garlands of flowers, angels' heads, the symbols of the Evangelists, rosettes and armorial bearings. The pulpit was designed by La Hire, the painter, and sculptured by Claude Lestocard. It is a mass of rich carving. A huge Samson supports the lower part, while upon the canopy are little angels of the winged-cupid tribe, and at the summit, a draped angel with a trumpet. The organ is also a fine example of seventeenth-century woodwork. But it is the glass of St. Etienne which is perhaps its chief glory. Although a great deal has been destroyed and patched up, much remains which is quite worthy of study, being as it is, in the best style of the sixteenth and seventeenth centuries, and the work of Jean Cousin, Claude Henriet, d'Enguerrand Leprince, Pinaigrier, Michu, François Périez, Nicholas Desengives, Nicholas Lavasseur, and Jean Mounier. But, unhappily, mendings and patchings have quite destroyed our power of discovering to which artist the different windows are due. In the *charnier* there is one very curious composition, illustrating the allegory of the wine-press: our Lord lies upon a table in the presence of the Father and the Holy Spirit, bathed in a sea of blood which flows from His side and feet. Underneath, the blood pours down through an opening into a large cask. Prelates and kings carry off to a cellar barrels, which have been filled with the Sacred Blood by the doctors of the Church, while the faithful run to the porch to receive the Blessed Sacrament.

[1] Continued from No. 609, page 97.

It is a strange design, and reminds me of something similar which I once saw in a little village of Tyrol: up a Way of the Cross was a tiny chapel, containing a life-size figure of our Blessed Lord; this was placed at the back, and in front was a pool of water — I imagine miraculous. A cup fastened by a chain allowed the faithful to drink thereof. But the strange part of it was the pool, which was supplied by water flowing from the hands and side of our Lord — no doubt symbolic of His being the Living Water, the well from which whosoever drinketh obtaineth everlasting life. The idea is somewhat materialistic to the mundane dweller in cities, but to the simple-minded inhabitants of Tyrol, it is full of poetry.

When the abbey of Port-Royal was destroyed in 1710, the body of Racine was transferred to St. Etienne and placed in the crypt of the Lady Chapel by the side of Pascal, and in 1808, a Latin epitaph composed by Boileau, which was discovered in the pavement of the church of Magny-les-Hameaux, was also transferred. The painter Le Sueur was buried in St. Etienne, though no monument was erected.

But the main attraction of St. Etienne is the tomb of Ste. Geneviève. Long before the Panthéon ceased to be the church of Ste. Geneviève, it was to St. Etienne that the faithful went to pray for her intercession and to have their rosaries placed upon her coffin. Here, any day, but especially during the octave of her *fête*, you may see people bringing handkerchiefs, rosaries, crosses, towels, etc., to be placed in the shrine, in order to carry the saint's blessing and help to the sick and the suffering. The stone coffin is said to have been found in the crypt of the abbey church during its demolition in 1801, but whether it be the original one in which the saint was buried in 511 it is impossible to say, as it is so surrounded by ornamental ironwork that its workmanship cannot be studied, but the effect of the little chapel containing this *tombeau*, with its lights and flowers and stained-glass, is very charming, and during the *Neuvaine*, when the church is ablaze with candles and hundreds of people *font queue* to the shrine, it is a sight not to be forgotten.

S. Beale.

ILLUSTRATIONS

[*Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.*]

AN INTERIOR IN THE HOUSE OF C. L. TIFFANY, ESQ., NEW YORK, N. Y. MESSRS. MCKIM, MEAD & WHITE, ARCHITECTS, NEW YORK, N. Y.

[Gelatine Print, issued only with the Imperial Edition.]

As Mr. Louis C. Tiffany had a large part in designing the interior fittings of this house, it is quite possible that it is his work that is here shown, and not the work of the architects who designed the building. We are enabled to publish this print through the courtesy of the Soule Photograph Co., of Boston, who hold a copyright on the only views of these interiors that are obtainable.

WOBURN FIVE CENTS SAVINGS BANK BUILDING, WOBURN, MASS. MESSRS. J. R. & W. P. RICHARDS, ARCHITECTS, BOSTON, MASS.

This building is 55′ x 80′, having two stores on the first story, the Savings Bank to occupy one-half of the second story, the remainder being appropriated as offices; the third story is to be occupied by the Young Men's Christian Association, and the fourth story is to be occupied as a club-room; the basement rear rooms are one-half for business purposes, the other for boilers, and the front portion for cellars and stores. The finish is of hard woods throughout. The exterior walls on three sides are faced with hand-pressed bricks, with Longmeadow stone trimmings. It has a Whittier elevator and is to be heated by steam, with open fireplaces to principal rooms. Total cost, $45,000.

PLANS OF VARIOUS EUROPEAN TECHNICAL SCHOOLS.

For description, see article published elsewhere in this issue.

THE INTERIOR OF ST. ETIENNE DU MONT, PARIS, FRANCE.

For description, see article elsewhere in this issue.

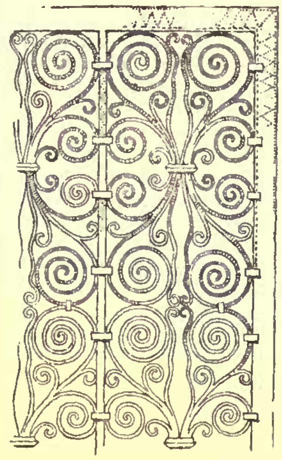
DESIGN FOR A SEASIDE COTTAGE. MR. E. G. W. DIETRICH, ARCHITECT, NEW YORK, N. Y.

CHURCH OF SANTA MARIA DE L'ANTIGUA, VALLADOLID, SPAIN.

A Possible Way of Erecting Obelisks. — The latest explanation of the way in which the ancient Egyptians erected their enormous monoliths and obelisks is that inclosures were made around the huge stones as they lay horizontally on the ground, floats were attached to the upper ends of the stones, water was then introduced into the inclosures and the monoliths were floated up straight. — *N. Y. Commercial Advertiser.*

THE MEDIÆVAL GRILLE. — I.

(From the French of Viollet-le-Duc.)



From the Cathedral of Puy-an-Valay.

In early Mediæval times they cast their grilles in bronze after the manner of ancient Roman gratings, and in the Church of Nôtre Dame at Aix-la-Chapelle there are famous grilles, cast in copper, dating from the time of Charlemagne, and probably made either in the East or by Byzantine artists in Lombardy.

Such castings while very expensive both in material and workmanship were easily broken, and it was not long until iron, commonly used in Gaul from an early period, was the preferred material.

The art of the smith was brought to wonderful perfection during the eleventh and twelfth centuries. The modern methods were not known. Iron was flattened into plates or hammered into bars by hand. The smith of to-day gets his iron from the mills in bars of all lengths and sizes; while his prototype of the Middle Ages found one of his chief difficulties in fashioning by hand long bars of equal thickness, well squared and straightened. And while we cannot ignore the immense advantages of mechanical workmanship, it is a certain and regretable result of improved appliances that the smith has, little by little, lost the knack of handling iron and the knowledge of the qualities of the metal.

The Mediæval smith, working his red-hot iron, turning it over and over upon the anvil, and bringing it gradually to a square, was naturally limited as to the size and length of the bar, and sought combinations by which to avoid long and heavy pieces. The most ancient grilles, therefore, are made up, so far as possible, of small pieces of ironwork. One of the oldest known grilles (Fig. 1) is at Puy-en-Vélay, in the Cathedral. This grille opens on a hinge and has an iron frame, 0.04m. by 0.02m., containing four cross-pieces separated by uprights of 0.015m. by 0.02m. set on edge, between which are placed very artistically wrought scrolls of iron. In the height of the grille there are five panels of scrolls welded at top and bottom, and held to the uprights by clamps not welded but simply put on hot. This grille probably dates from the beginning of the twelfth century. The smith seems to have conceived the idea of hiding the usual irregularities of hand-worked iron by covering the uprights, frames, (Figs. 2 and 3) scrolls and clamps with the dents and incisions which give such a rich effect to this piece. The traceries were executed upon the cold iron.

Their very irregularity gives a peculiar charm to these pieces, in which one feels, above all, the hand of man.

During the twelfth century there was little change in the fashion of the grille. There were always the uprights in a frame

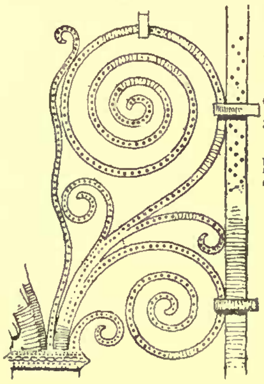


Fig. 2.

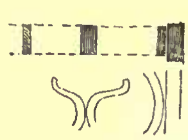


Fig. 3.

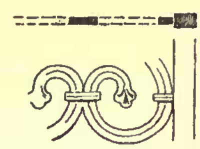


Fig. 4

filled in with ornamental scrolls of square or flat iron. Strength was gained by setting the uprights and spirals on edge (Fig. 3) an appearance of lightness by putting them on the flat, showing their broad side to the front (Fig. 4.) In a geometrical drawing exactly the opposite effect is produced.

The architects of the Middle Ages, however, thought rather of the perspective effect of the executed work, and it is clear that the greater part of the grille being seen from an oblique point of view, the iron set on edge develops the greater breadth (Fig. 5a) and strength to the eye, while in that set flat (Fig. 5b) the broad faces diminish in perspective and the narrow edges do not fill up the spaces between the uprights.

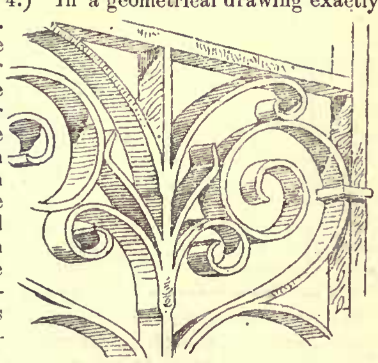
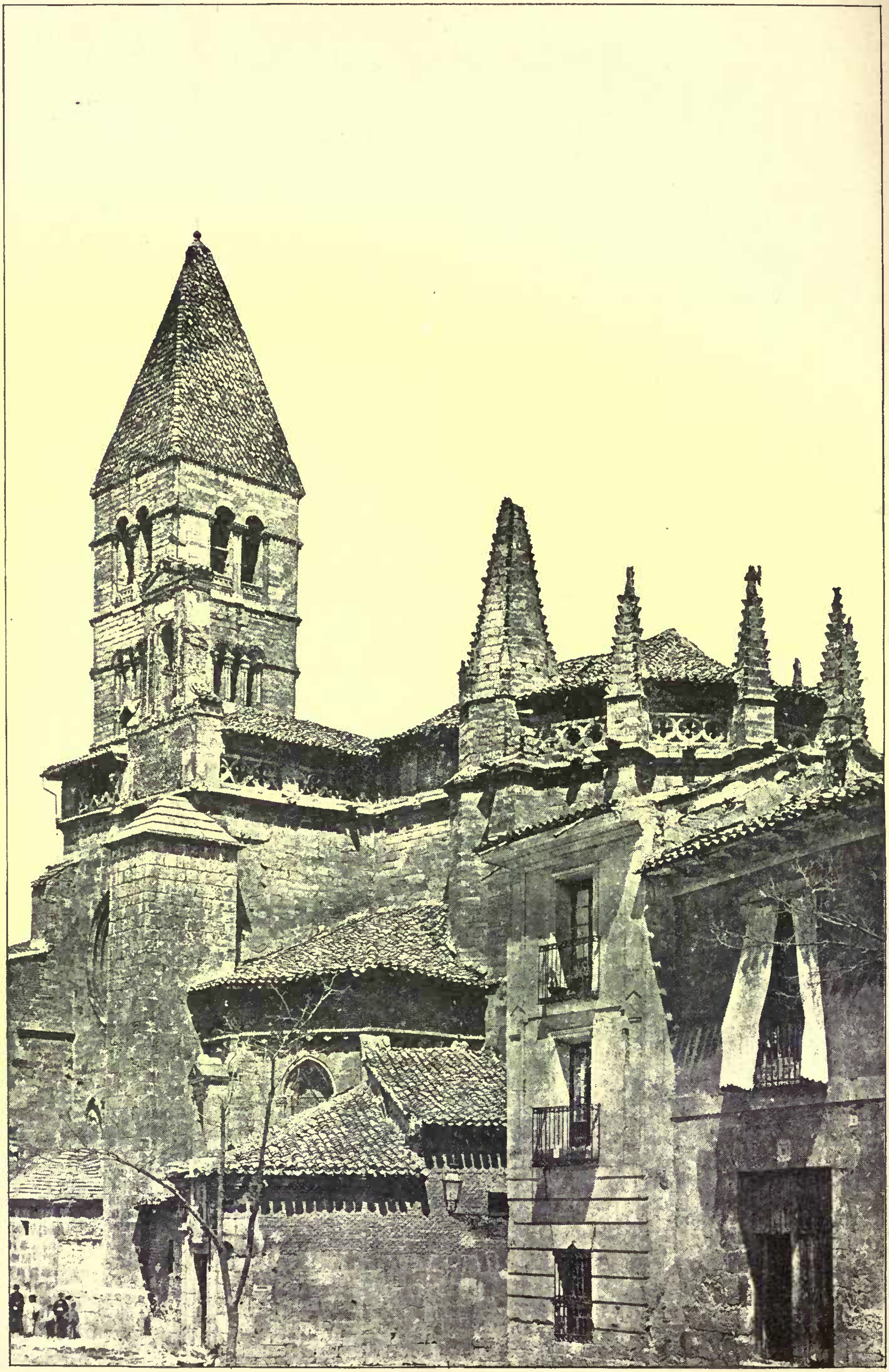


Fig. 5a.

Toward the end of the twelfth century the ironworkers, seeking new combinations, produced some great designs by the grouping together of ornamental panels in grilles delicately wrought of light iron. M. Didron has a



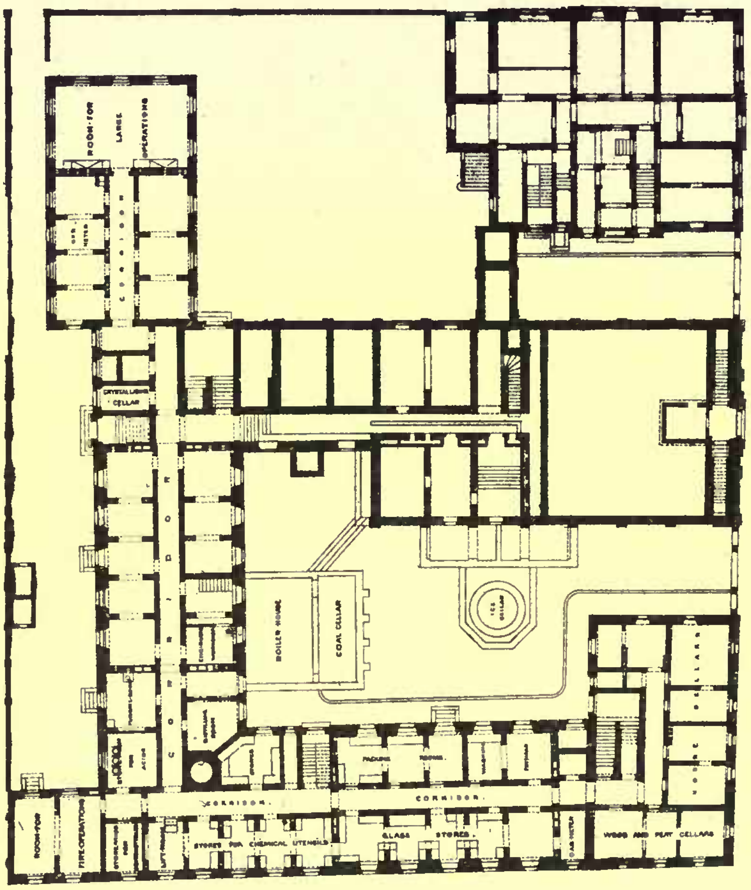
Nave of St Etienne du Mont, Paris, France



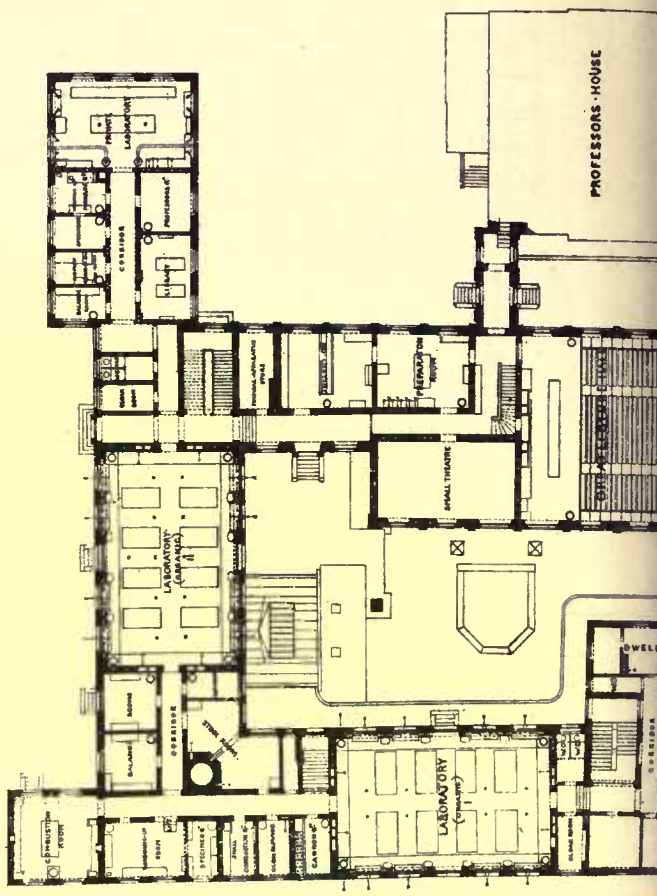
Heliotype Printing Co. Boston.

Church of S. Maria de l'Antigua, Valladolid Spain

MUNICH UNIVERSITY · CHEMICAL LABORATORY.



BASEMENT FLOOR PLAN.
FIG. 1.

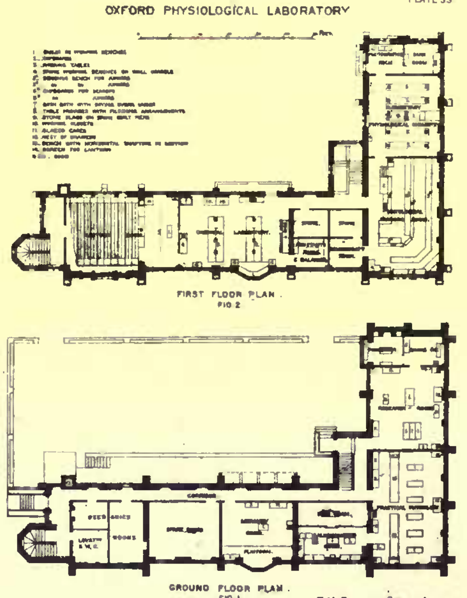


GROUND FLOOR PLAN.
FIG. 2.

SCALE OF FEET.

OXFORD PHYSIOLOGICAL LABORATORY

PLATE 33



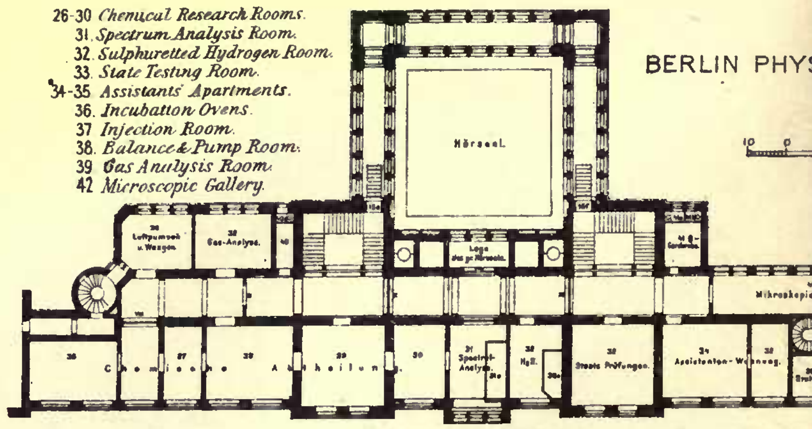
FIRST FLOOR PLAN.
FIG. 2

GROUND FLOOR PLAN.
FIG. 1

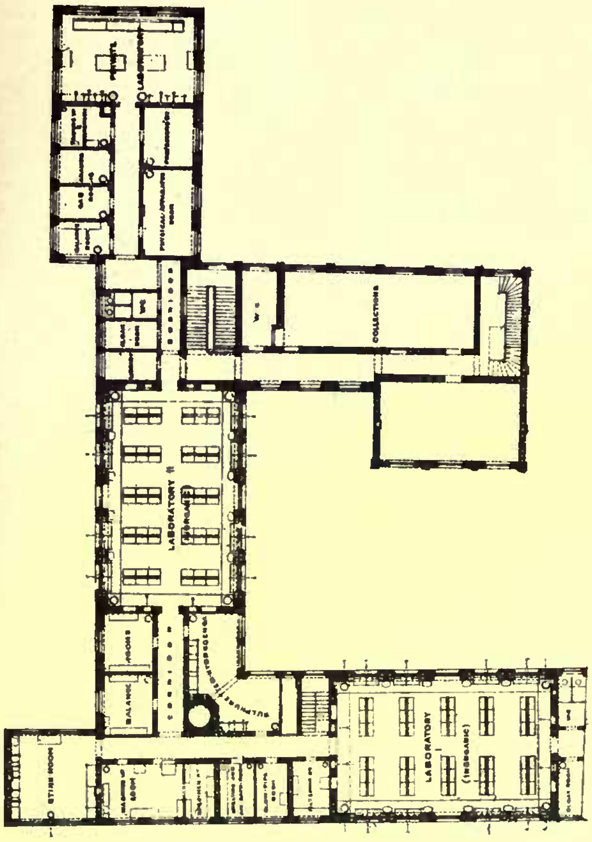
T. N. DEANE & SON, ARCHITECTS

BERLIN PHYS

26-30 *Chemical Research Rooms.*
31. *Spectrum Analysis Room.*
32. *Sulphuretted Hydrogen Room.*
33. *State Testing Room.*
34-35 *Assistants' Apartments.*
36. *Incubation Ovens.*
37 *Injection Room.*
38. *Balance & Pump Room.*
39 *Gas Analysis Room.*
42 *Microscopic Gallery.*

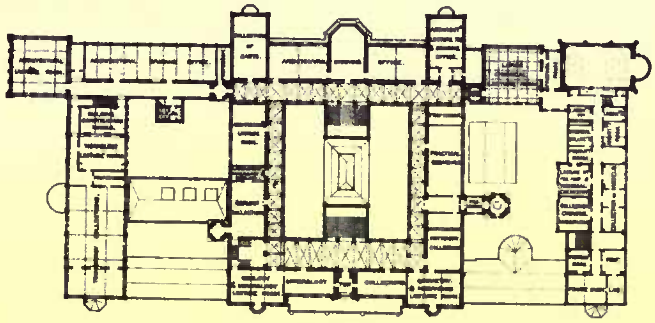


FIRST FLOOR PLAN.
FIG. 3.

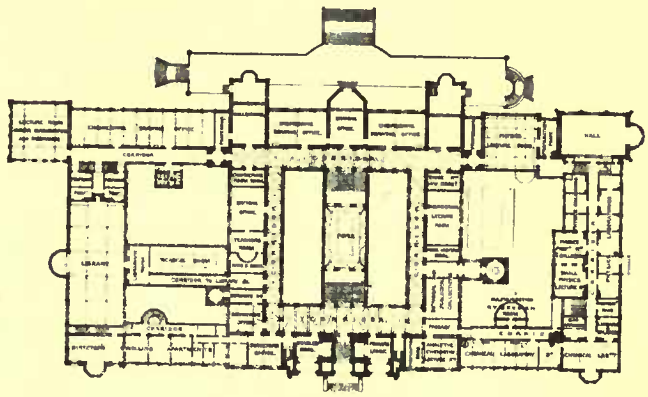


FIRST FLOOR PLAN.
FIG. 3.

HANOVER TECHNICAL HIGH SCHOOL

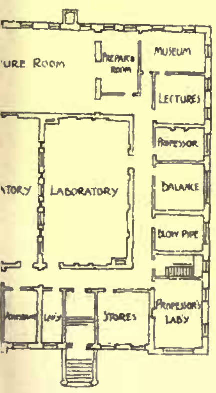


FIRST FLOOR PLAN



GROUND FLOOR PLAN

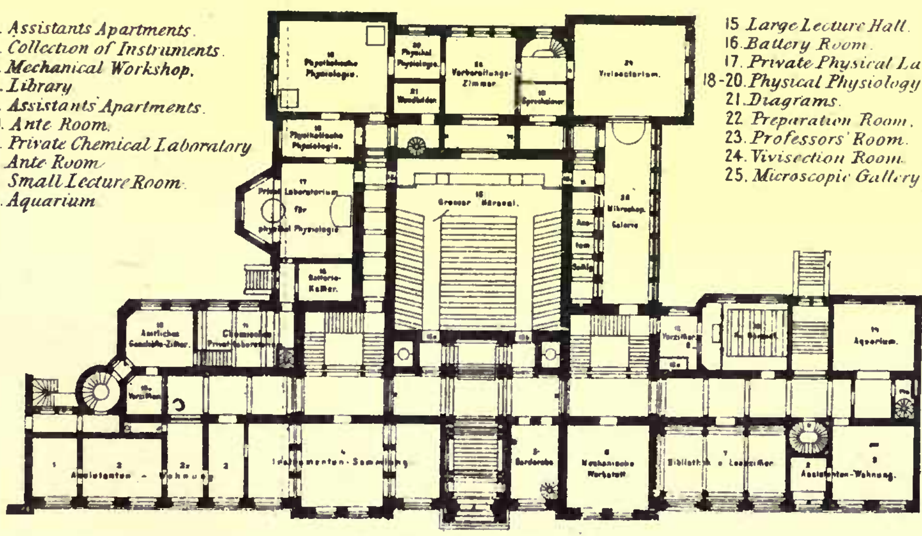
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CAL INSTITUTE.

OF FEET.

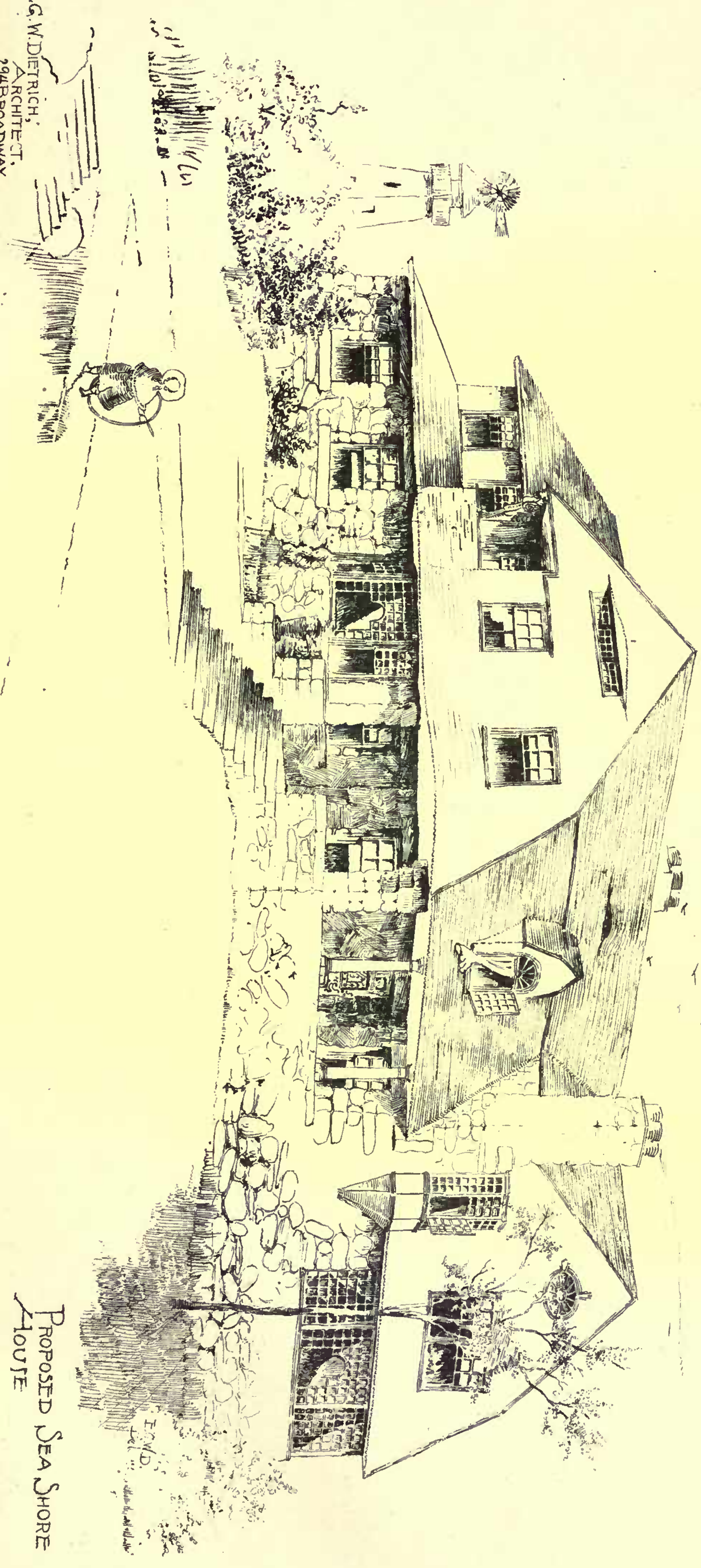
40 50 60 70 80 90



1–3. *Assistants Apartments.*
4. *Collection of Instruments.*
6. *Mechanical Workshop.*
7. *Library.*
8–9. *Assistants' Apartments.*
10. *Ante Room.*
11. *Private Chemical Laboratory.*
12. *Ante Room.*
13. *Small Lecture Room.*
14. *Aquarium.*
15. *Large Lecture Hall.*
16. *Battery Room.*
17. *Private Physical Laboratory.*
18–20. *Physical Physiology Laboratory.*
21. *Diagrams.*
22. *Preparation Room.*
23. *Professors' Room.*
24. *Vivisection Room.*
25. *Microscopic Gallery & Anatomical Collection.*

GROUND FLOOR PLAN.
FIG. 2.

E. G. W. DIETRICH,
ARCHITECT,
294 BROADWAY,
NEW YORK.....



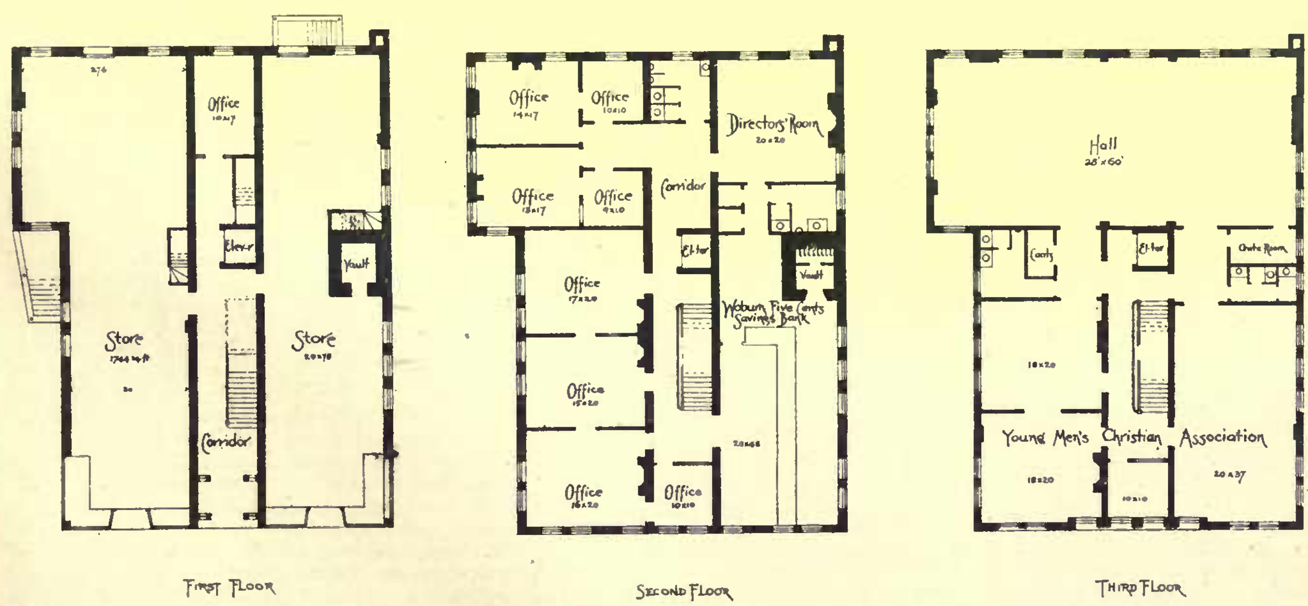
PROPOSED SEA SHORE HOUSE

Heliotype Printing Co. Boston

AMERICAN ARCHITECT AND BUILDING NEWS, DEC. 10 1887. No. 624.

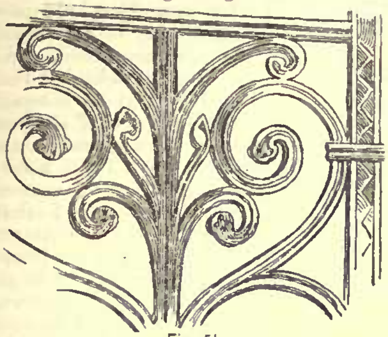
Building at Woburn, Mass.
for the
Woburn Five Cents Savings Bank.
Jos. R. Richards
Wm. P. Richards ~ Architects.





Heliotype Printing Co. Boston.

very beautiful example of such work, illustrated in the "*Annales Archéologiques*," which may with certainty be assigned to the end of the twelfth or the beginning of the thirteenth century.


Fig. 5b.

Grilles of scroll-work with their simple incised enrichments seemed, to the twelfth century smiths, not of sufficient richness of design for use in churches and important civil edifices, and by degrees they began to further finish the scrolls with ornaments impressed upon the heated metal with a stamp or mould of tempered iron.

In the Abbatial Church of St. Denis there may still be seen what is left (Fig. 6) of some very beautiful grilles of this description. They date from the end of the twelfth century, and were forged with such rare skill that the iron seems to have been brought under the hammer of the smith to the malleability of lead. The ornaments are stamped on one face only.

Grilles composed of ornamental panels set between the uprights and cross-pieces were at once light and strong; the panels, sometimes simple, sometimes generously enriched, could be taken out, repaired and put back easily. The uprights were sometimes covered with overlapping plates which formed grooves into which the panels were fastened.

Sanctuary grilles were occasionally made in this way — there is a beautiful example of the kind in the choir of the Abbatial Church of St. Germer — and fragments are discoverable everywhere in numbers which indicate that work of the sort was by no means rare. Cabinets of precious articles, reliquaries, tombs and shrines were sometimes enclosed by grilles of extreme richness and beauty, and the most perfect examples of this kind belong to the thirteenth century, when the art of the smith achieved its greatest triumph. These grilles were decorated only on the exterior surface, and the spirals, instead of being enclosed between the uprights and the cross-pieces, were often applied to the outer face of the frame. The tomb of Queen Eleanor in the choir of the Abbatial Church of Westminster is protected by a very beautiful grille of the kind described, and there are in the storehouses of the imperial Church of St. Denis fragments of grilles forged and joined in this manner (Fig. 6b.) which had the advantage of greatly strengthening the simple framework of uprights and traverses. The finely forged scrolls were retouched with a graver and riveted to the iron frames, to which they added great richness as well as stiffness.

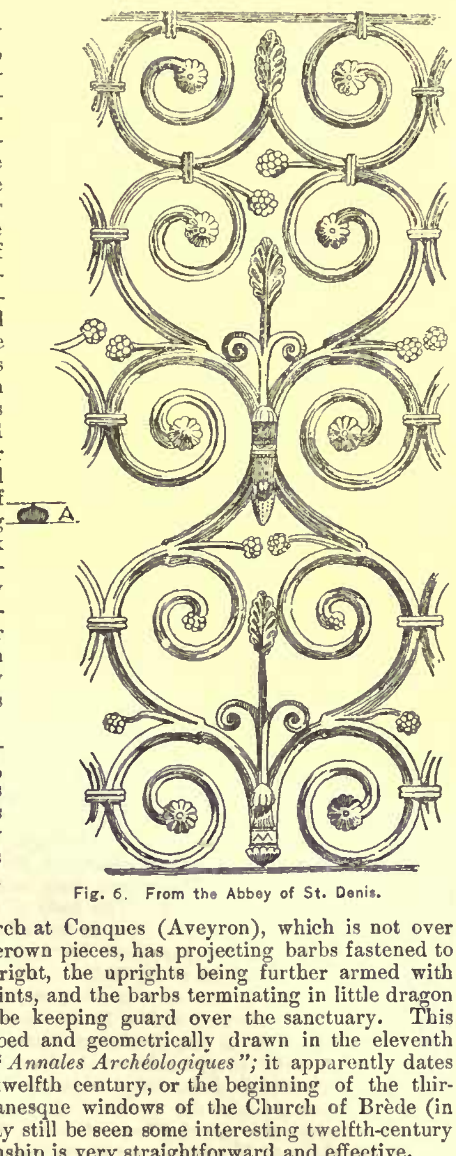
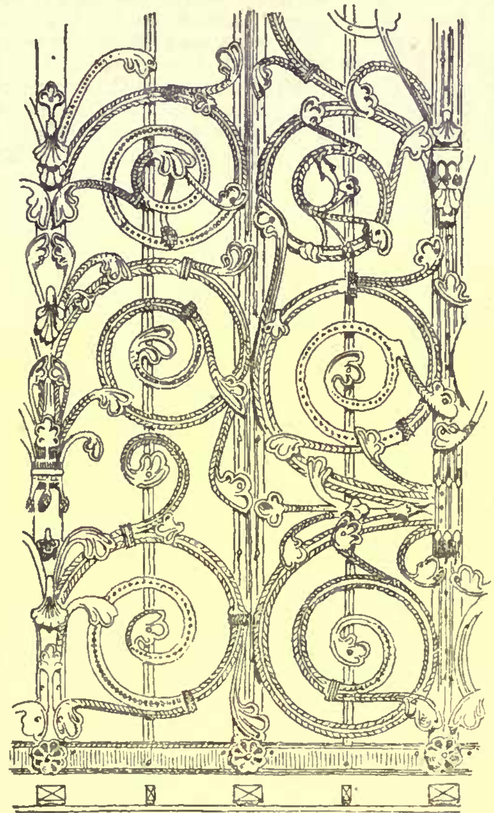


Fig. 6. From the Abbey of St. Denis.

Grilles for the defense of treasures, sanctuaries, rich tombs or precious reliquaries sometimes fairly bristled with points and unscalable spikes. One (Fig. 6c.) in the sanctuary of the Church at Conques (Aveyron), which is not over 1.40m. high with the crown pieces, has projecting barbs fastened to the outside of each upright, the uprights being further armed with nicely forged iron points, and the barbs terminating in little dragon heads, which seem to be keeping guard over the sanctuary. This curious grille is described and geometrically drawn in the eleventh book of M. Didron's "*Annales Archéologiques*"; it apparently dates from the end of the twelfth century, or the beginning of the thirteenth. In the Romanesque windows of the Church of Brède (in the Gironde) there may still be seen some interesting twelfth-century grilles, whose workmanship is very straightforward and effective.

The windows are 0.26m. wide and 0.90m. high. The guard consists of a single vertical bar of iron. (Fig. 7.) 0m. 03. square, with cross-pieces fixed like pins through the enlargements of the bar. The cross-pins are flattened, 0.02m. by 0.007m., and scrolls of flat iron, 0.03m. and 0.004m. are pierced and held in place by them. The bar is sharpened at its upper end and set into the keystone of the arch, while the lower end is fashioned into a *queue de carpe*, or fish-tail, to give it a good fastening. There is no welding but simply a combination, in the most natural way, of small pieces of iron.

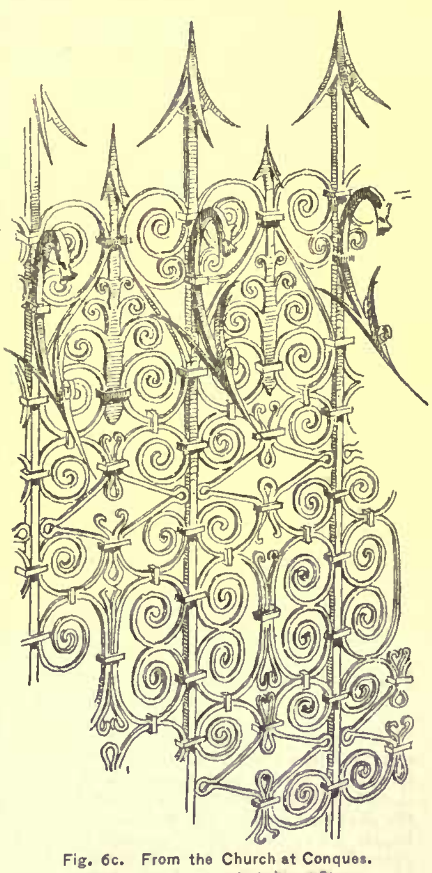

Fig. 6b. From the Abbey of St. Denis.

Certain other thirteenth-century grilles (Fig. 8) are made of vertical bars of flat iron, 0.035m. by 0.02m., with keys piercing them and riveted in the form of a cross. (Maison à St. Antoine, Tarn et Garonne.) The rivets are squared to prevent the keys slipping.

A very beautiful fan-light grille, discovered at Agen (Fig. 9), Rue St. Antoine, by M. Alaux, an architect, now decorates the arched door-way of a house of later date. The centre of the grille is lost; the remainder fills a complete half-circle of 1.60m. diameter. Six panels shaped like voussoirs fill the arch, and are held in place by two half-circles and seven radial bars, the panels being formed of scrolls or tendrils of iron 0.008m. square, welded with light pieces in the manner used by smiths of the thirteenth and fourteenth centuries.

An example is given of the decoration of grilles with stamped ornaments. In this case the irons are stamped and ribbed upon their flat sides; the ornamentation of the narrow sides or edges of the scrolls, a feat frequently accomplished by the thirteenth-century smiths, was a more difficult process.

There are in the Church of Braine, near Soissons, some portions of a grille (Fig. 10) of very charming design forged as above described. Very light in appearance, an effect caused by the presentation of the edges of the irons, such grilles yet have great stability. The work in the panels is of a difficult character, the irons being stamped on two sides. The thickness of the edge diminishes considerably toward the extremity of each limb, and the ornaments are confined to that reduced thickness.


Fig. 6c. From the Church at Conques.

Meanwhile, the art of the smith in France was not at a standstill, and was, on the contrary, continually seeking new methods, new forms of expression. In the beginning of the fourteenth century the stamped ornamentation of grilles and the method of putting together without welding as seen in those of St. Denis, St. Germer, St. Aventin — see Gailhaband's "*L'Architecture du V au XVII^e Siecle*

et les arts qui en dépendant" — were no longer in vogue. Other combinations were sought, plaques of hammered iron cut out and modelled, taking the place of designs stamped in the full iron. The smith now aimed for more effect with less labor. The iron industry was advanced, the art was lost. Rivets replaced shoulders and collars, and even supplanted weldings, the tendency being

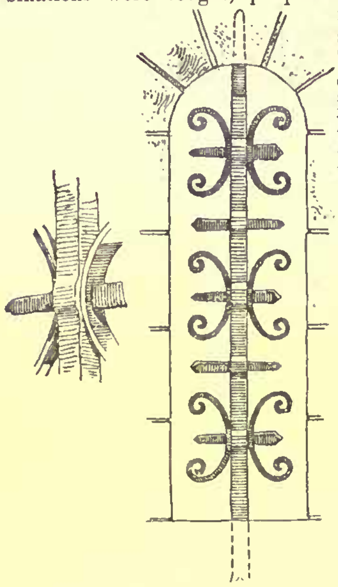


Fig. 7. From the Church of Brede.

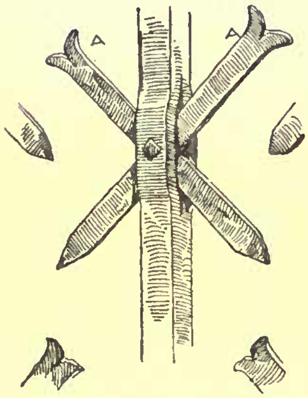


Fig. 8.

toward cheap and quick work. In the processes of handling and firing iron, the artificers of that day were far in advance of the workmen of our time, and the most remarkable qualities of their pieces of delicate workmanship are the evenness of the execution

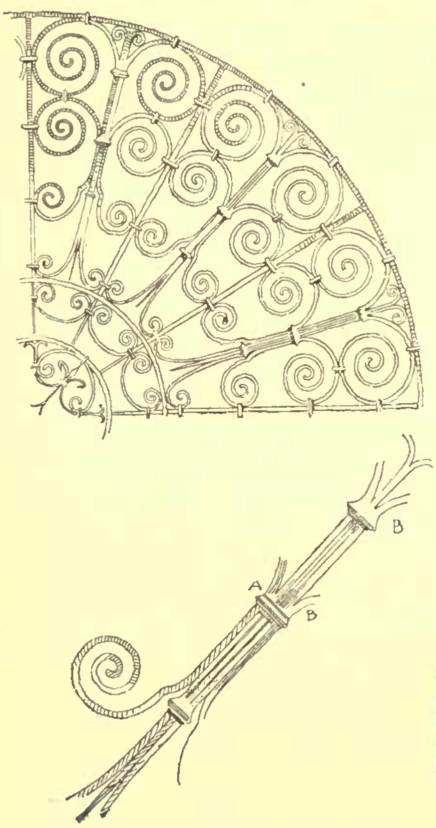


Fig. 9. Fan-light at Agen.

FIG. 10.

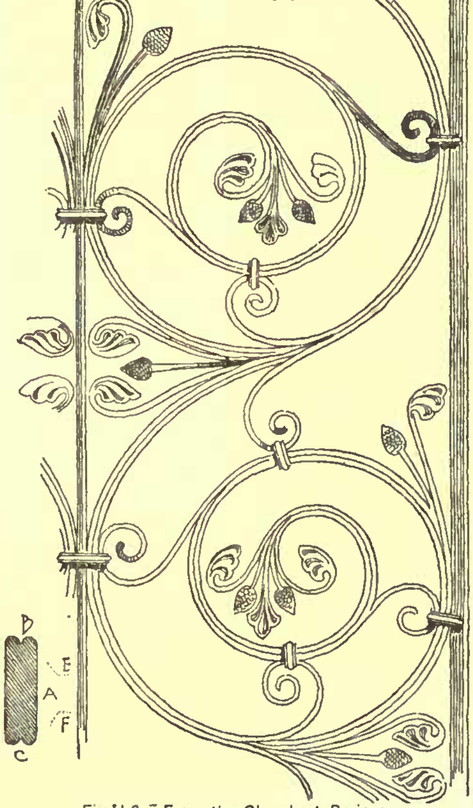


Fig. 10. From the Church et Braines.

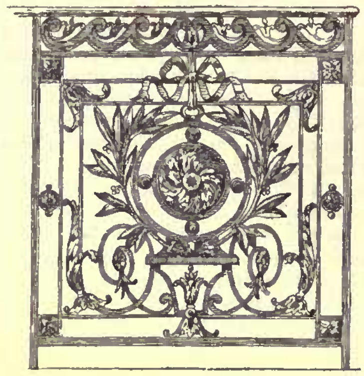
and the maleability remaining in the metal. The iron of the ancient grilles, although it must have passed through the fire a great number of times, is never burned; it retains its flexibility and the weldings are made with a perfection, and at the same time a freedom, very rarely found to-day.

[To be continued.]

Inscriptions on Buildings in Paris. — He that runs may soon read a good deal of biographical history on the walls of houses in which famous men were born and died. The Committee on Parisian Inscriptions has just drawn up seventeen, two of which are on the asylum for the deaf and dumb. The first of the two states that the Abbé de l'Epée began his self-appointed mission to the deaf and dumb in 1760, and opened a school for them in a house now demolished in the Rue des Moulins, where he died, surrounded by his pupils, on December 23, 1779. The second, which runs as follows, is from a decree of the National Assembly, dated July 21, 1789: "The name of the Abbé de l'Epée, founder of this asylum, will be placed in the list of those citizens who have best deserved of their nation and of the human race." The committee has decided to place a slab on each public building, whereon will be inscribeda brief account of its history. — *London Daily News.*

PARIS GOSSIP.

Paris, October 26, 1887.



Wrought Iron Balcony.
M. Thiriot, Archt. Paris.

The fortnight which has just passed has been quite interesting so far as exhibitions are concerned. We have had at the School of Fine Arts the Attainville competition and the *envois* of the pensioners at Rome, and at the Gallery Georges Petit, a very curious exhibition of contemporary engravings. I shall say very little of the Attainville historical and landscape painting. It was very weak. The prize of 2,100 francs was not awarded to any of the competitors. The subject for the historical painting was the decoration for the background of a gallery in a small museum. The bust of the artist who founded the prize was to occupy the middle of one of the panels, and all the *motifs* of decoration were indicated in the programme. There was not a shadow of an opporunity left to the imagination of the competitors. The work was to be highly colored, the pilasters and sub-basement being in variegated marbles.

As may be seen, architecture held a specially-important place in the competition. Alas! can the name of architecture be applied to what was laid before us? Either the competitors are very young, or if it is absolutely necessary to give such subjects for painters to treat, much more elementary notions about columns, capitals, arches, entablatures and simple mouldings should be first instilled into them. The unfortunate artists never had a misgiving. One cannot picture a similar exhibition of inexperience. I make an exception in favor of M. Duffet, who obtained a mention. His was certainly the most decorative design, having a certain amount of brilliancy in color and a fairly-good arrangement of the architecture, better studied, although very *naïf.* Two mentions were awarded to MM. Daudin and G. Roussel Why, I cannot imagine. The competition in landscape was not much better. The subject, nevertheless, was attractive. The competitors were asked to interpret these pretty lines of Millevoye:

> De la dépouille de nos bois
> L'automne avait jonché la terre.
> Le bocage était sans mystère
> Le rosignol etait sans voix.
> Triste et mourant à son aurore
> Un jeune malade à pas lents
> Parcourait une fois encore
> Le bois chers à ses premières ans.

An artist had a very pretty chance, with such a subject, to show us a young invalid amid a melancholy, autumn, country landscape, full of sentiment and reverie. Alas! once more alas! where, in the works shown, is there any trace of sentiment or reverie? Perhaps a little in the canvas of M. Blanchecotte, the general tone of which was good, but a little too uniform, too gray. M. Blanchecotte had a mention. Perhaps he would have won the prize if he had borrowed from his comrade, M. Signoret, who also got a mention, some of his lifelike tints of dead leaves. Mention was also awarded to M. Bellet, whose very able and decorative landscape showed us a pretty effect of the setting sun reflected in a lake, but no bit of sentiment.

Let us pass next to the Roman paintings. The painting was ordinary enough, nothing absolutely bad, but, on the other hand, nothing very good. The most important work is the Ste. Praxine of M. Popelin, a fourth-year pupil. The body of the young martyr, Ste. Praxine, has been cast into a pit in the midst of other corpses, but is not affected by decomposition. In this canvas there were certain qualities of composition: the body of Ste. Praxine, the principal figure, is clearly of the first importance, and attracts immediate attention. It is covered with a luminous white robe, too white, in fact, since the scene is laid in a cave, where the colors must be sombre. Perhaps the preservation of the body of Ste. Praxine is facilitated by the absence of the body itself, for only with great difficulty can one detect it under the gown which covers it. In any case, it is too flat, though the painting is good.

M. Baschet, of the third year, sends a copy of a fragment of one of the frescos of the Sixtine Chapel. I do not recall the original,

but the impression one derives from the copy is that it must be treated with great fidelity and absolute correctness.

M. Pinta, of the second year, shows us a Ste. Martha clothed in a magnificent cloak of cloth-of-gold. She holds against her breast a young person clothed only by her red hair. This young girl seems to be quite ashamed of her nakedness, and conceals her face in the bosom of Ste. Martha. The painting is luminous enough, but not very attractive. The nude figure has some bits extremely well modelled, but the pose is not a happy one, for she does not appear to be resting upon her feet, but looks as if she were hanging.

M. Axilette, of the first year, sends two nude figures and one drawing. The two nude figures are both seen from behind, and, unfortunately, have the same pose. One of them, a Diana, of ungraceful movement, but with flesh tints, warm and lifelike; the other a bather, with legs too violet in tone and lacking in equilibrium. M. Axilette ought to give more attention to his drawing.

The sculpture is better than the painting. M. Ferrary, who is in his fourth year, shows a decapitation of St. John the Baptist, which is very fine and attracts strongly. The executioner, standing with head half-hidden by a bit of drapery, showing only the eyes, holds in one hand the hilt of his cimeter and the head of St. John. One feels the energetic physiognomy of this man and his very glance, so powerfully is it rendered. The body of St. John, fallen in a heap at his feet, gives an admirable impression of the inert suppleness of a still warm corpse. By the side of the plaster cast is placed the partly-finished group in marble.

M. Puech, of the second year, shows us the muse of André Chenier: a nude young girl is holding the poet's head in her arms and bestowing a kiss upon his brow. The idea is pretty and graceful, though the interpretation is less so, and does not sufficiently bear out the delicacy of the sentiment, while in this particular the *envoi* of M. Gardet, of the first year, is very charming. This is a very pretty bas-relief in bronze, called "The Idyl," the everlasting idea of a young man and a young girl making love beside a fountain. This is very graceful. The background is a well; the two figures are arranged in very natural position, except that the young man who is almost naked, is a little too primitive in his attire to be grouped with a young girl admirably arrayed in the clothes of a modern peasant girl; and yet the effect is very chaste. M. Gardet sends at the same time a beautiful marble copy of the torso of the Faun in the Museum at Florence, and an important bas-relief in plaster, "*Sursum Corda*," a grand patriotic composition of a sufficiently imposing air.

M. Naudé, medallist of the second year, sends a wax sketch showing a pretty pastoral scene, a design after Bellini, and an engraved medal, "St. Cecile."

Next for the architecture, which ought to be most interesting for us; but once more alas! I shall never be able to understand the use, the interest and the aim of all these studies by the architect pensioners at the Villa Medici. Here are artists who have at the École des Beaux-Arts made the studies which we know; they have in their *ateliers* studied in detail all the beautiful monuments of antiquity, with their columns, capitals, pediments, etc.; they have made there fine designs well studied and carefully rendered. It is on work of this kind that they have obtained their scholarships at Rome. What, then, remains for them to learn? Their trade? I do not wish for the moment to speak of it, though that can be of some use; but it seems to me that even from the point of view of art and grand architectural studies, there might be something else for the winners of the prize at Rome to do than to remain four years in an Italian city spending their time in measuring every leaf of a capital, or the moulding of an entablature, and making the ideal restorations which they send us year by year, which are afterwards buried in the Government storerooms. These studies, evidently very seriously and conscientiously made, represent a considerable amount of time and labor. They have, perhaps, a certain archæological interest, and to entirely suppress them would be a mistake; but it might be arranged that they should not form the most important part of the work of the pensioners. Why should these drawings be rendered with such perfection? Why such neat washes, so "licked" — a colloquial but very proper expression? We know already that the prize men of Rome know how to draw and lay on washes. Why this special sojourn at Rome? The better coronation of their studies at the school would be for them, as for every other architect, to travel and study in every country. Does not France contain as interesting monuments as those at Rome? Are they as well known? Does not the architecture of our ancient churches, palaces and châteaux give opportunity for as interesting and more practical studies than the old façades and porticos and palaces of Italy, however beautiful they may be? Has not Spain also an interesting architecture, and likewise Germany, Belgium and Holland? Let us say at once that all Europe offers from this point of view an interest which we do wrong to neglect; and if the pensioners at Rome, studying the monuments of every country, should bring back drawings and rapid sketches and measured drawings, they would probably derive more profit, and we also. I know that to do this would be a revolution all the more difficult to bring about, that it would overthrow the antiquated habits and regulations of the Institute.

Meanwhile (and we have plenty of time to wait), let us glance at these last *envois*. M. Deglane, pupil of the fourth year, has made a restoration of the Palace of the Cæsars. On eight large frames we see displayed the large plans, which are interesting enough, and façades quite as important as the plans. All this is very firm in drawing and skilful in rendering, and is the result of a great amount of work. Still, I may dare to say that the present state of the façade of the ruins is much more picturesque and agreeable to contemplate than the restorations here shown.

M. Esquié, also of the fourth year, sends the restoration of the Villa Adrian at Tivoli. The façades are more gay and interesting than those shown by his companion. Apart from this slight difference, I might say the same of this as I said of the other.

M. Redon, of the third year, sends a restoration of the great garden façade of the Villa Medici. It is full of bas-reliefs and sculptures, which are very well drawn and rendered. His washed drawing of the Temple of Concord is also very correct.

M. D'Espouy, of the second year, shows two pretty water-color studies of interior decoration from the Campo Santo at Pisa, the Hôtel Via de Clerici at Milan, and the Villa Medici. With these, also, certain perfectly well-known details of sculpture and architecture in India-ink washes. These are absolutely beyond criticism, and are neat beyond expression.

M. André, of the first year, sends some nice drawings. These are less above criticism, and of no great interest.

It only remains for me to beg my readers to keep in mind this description of the architectural *envois*, for if I have the pleasure of speaking of those sent in next year, it will probably be exactly the same thing, and it will only be necessary for them to change those names which I shall point out. M. BRINCOURT.

LIGHTNING.



WINDOW FROM HOUSE AT PERIGUEUX.

THUNDERSTORMS are, as is well-known, much more frequent in summer than in winter. Statistics recently collected in France show that during the three hot months of summer, lightning strokes, whether to animals, trees, or buildings, are by far the most frequent; whilst during the winter months there are few or none. The cause of this is not very apparent; but a German writer has attempted to show, from observation and experiment, that electricity is generated by the friction of water vapor in the atmosphere; the vapor being raised up by the sun's heat. Friction of water particles has been known to generate electricity since the days of Armstrong's electrical machine, in which a jet of steam escaping from a narrow pipe is found to be electrified. The mere evaporation of water may or may not give rise to electricity; the question is at least a doubtful one; but the effect of rubbing of water particles against a mouth-piece is undoubted. There is also reason to believe that the particles striking against each other, or the atoms of the air, also give rise to electricity. The vapor thus charged condenses into floating masses which we term thunderclouds.

Now as a charge of electricity has the property of inducing another charge of electricity of an opposite kind to itself on any "conducting" matter near it, and as the earth is composed of what is called conducting matter, it follows that a charged cloud sailing over the surface of the earth induces an opposite charge on the ground below.

These two opposite charges, one of "positive" the other of "negative" electricity, tend, by another well-known property of electricity, to rush towards each other and combine. Hence when they are able to overcome the resistance of the air between, which keeps them apart, they leap together with a flash and crack, producing the familiar phenomena of thunder and lightning.

It is the old story of the electric spark. When a rod of dry sealing-wax is rubbed with the warm hand or a silk handkerchief, it becomes electrified, and if it is then held near a piece of metal, a tiny spark accompanied by a faint snapping sound will be observed. In this experiment the sealing-wax corresponds to the cloud and the metal to the earth, and the spark which passes between them is the lightning.

Sometimes another cloud floating near the first one takes the place of the earth, and then the lightning flash takes place between them. Lightning of this kind does not strike the earth; but it might have a destructive effect on the latter for all that, because it might give rise to the "back-stroke," which is sometimes fatal to life.

The "back-stroke" is not due to the direct flash and discharge. It is rather the reaction after the direct discharge has taken place elsewhere. Suppose, for example, that a tract of upland country, a rural district with trees, farms, and here and there a church dotting it, is covered by a thundercloud, which induces a charge of electricity upon it. In order that the charge upon the earth may get nearer to that upon the cloud so as to combine with it, the electricity, by another well-known property, will heap itself on the most prominent and pointed objects of the landscape. That is to say, it will accumulate on the trees, barns, chimney-tops and spires of the district.

The whole atmosphere of the region is in a state of tension and suspense. The bolt is trembling in the balance, but no man knows

where it will fall. Presently there is a blinding flash of light, the sky is rent with a lurid stream of fire, and instantly the tension is relieved. The discharge has taken place at one point, the point which offers the path of least resistance through the air, and at which the electric tension was most critical. At every other place where the electricity had seriously accumulated, there is consequently a sudden fall of electric potential, or a collapse to its old condition, or, as it is called, a "return stroke." This instantaneous change is sometimes as fatal as the direct discharge, and it may ruin a building or destroy life several miles from the scene of the flash. The direct stroke is, therefore, more mysterious and unexpected than the flash, but fatal effects are comparatively rare from it. Nevertheless, since the latter have been attributed to this cause, a person cannot feel quite safe, although a thunderstorm with lightning is still several miles from him; the number of miles being estimated by counting the seconds which elapse between the flash and the peal, and allowing a distance of one-fourth mile for every second counted. He may feel safer than if it were close upon him, but there is still room for fear.

In fact there is no real safety except within the area properly protected by a lightning-conductor, or in a building which is itself a protector, for instance, a sheet-iron house. Every building, then, should be protected in order to be safe. In the country, where these are often isolated, a lightning-rod would be required for each; but in towns one rod would sometimes protect more than one house around it, according to its height and conductivity. Lightning-rods, as they are now made of copper, are so expensive that most people prefer to trust their chances of escaping a discharge rather than have their homes protected. Yet a change of feeling in this respect will probably come about in course of time, especially if lightning-rods can be had, as they are likely to be, for a trifling sum. It is important, however, that the rod should be properly planted with a good "earth" connection, and properly run up above the chimney with pointed ends into the air. Although the rod may be a simple affair, for example, two or three twisted lengths of telegraph wire, it should only be applied to the building by a person skilled in the work, or else it may invite instead of warding off destruction.

Thus bare electric-light and telegraph-wires running on poles in the open air have sometimes been taken into buildings carelessly, and by providing a path of less resistance for the lightning to "earth," have brought the discharge down upon the roof of the building. The effect may be more forcibly realized by conceiving a person to carefully plant the bottom of his lightning-rod in connection with the earth and then take the other end indoors, instead of running it outside the house until it cleared the roof.

The flash takes place at the point of least resistance, because it is here that the two opposite electricities can easiest rush together. But the eagerness with which they tend to rush together is another thing to be considered. These two things taken together determine the discharge. There may be less resistance to the flash at one house or tree than at another, but if the attraction between the opposite electricities is less at the former, the flash may traverse the latter house. Hence one cannot exactly say if one tree or building will be safer than another. There is great uncertainty, and this is a reason for the instinct of awe and uneasiness which most animals feel on the approach of a thunderstorm.

In general, however, we can say that high houses, or those perched on high ground, are more likely to suffer from the discharge than small, low-lying houses. The former are, therefore, all the more eligible for protection; and they are to be avoided in seeking shelter from a storm. So are houses surrounded by trees, and with ponds or pools of water close beside them; for trees act as imperfect lightning-rods, having a good earth connection, and especially if they are wet the discharge may strike the house in order to reach the ground through them, or in the case of the pond, through the water. One should not shelter under trees of any kind, but more especially tall soft trees like poplars. Many deaths have been incurred from sheltering under poplar trees in France.

Thunderstorms are said to be more frequent in open, treeless countries such as the Transvaal or the Scottish hills, and the fact has been attributed to the unchecked ascent of electrified vapors; but on the other hand they are probably less destructive in such countries. One fatal accident a few years ago may be remembered by many, that is, the death of Lord Lauderdale, who was killed by the discharge while out grouse shooting. The discharge entered his forehead, and after emerging at his breast left the marks of its passage in two streams down the left leg. The brain and spinal cord being of nervous matter are better conductors than other parts of the body, and hence are not disturbed to the same degree as the latter. The flesh is sometimes rendered livid, and at others quite charred. Curious pink prints, as of arteries and trees, are sometimes left on the skin by the fluid; and watches are fused, clothes singed and boots torn into shreds or pierced through, as happened in the case of Lord Lauderdale. Often death is quite painless, since it occurs before the brain has time to feel; but at other times, as in the Lauderdale instance, it is accompanied by intense suffering. Those who are not killed outright and recover their senses, tell of feeling a heavy blow when the shock came, and the disintegrated and disordered system occasions them severe pain.

Chimneys, by creating currents of warm smoke, and by their lining of conducting soot, are dangerous parts of houses, and there are many instances of the discharge taking that road. It were better, then, to avoid sitting near a fire in a storm. Indeed, the safest place in the house on such an occasion would seem to be in cellar and basement-rooms, or upon an iron bedstead. In the open air, there cannot be a safer place than a dry hole or ditch, for it places the body below the surface of the ground, and, therefore, not exposed on a prominent place. But it should be a dry hollow else the water in it may invite the discharge; for water being a conductor in good connection with the earth, lowers the resistance to the discharge.

Fire-balls are the comedy of lightning, and play the "antic part.' Many singular feats are recorded of them, such as quietly floating down a chimney, and after astonishing the inmates of the room, suddenly disappearing up the chimney with a flash and bang. They are frequently witnessed, and a flash of lightning was seen during the past summer from Westminster Bridge to throw out fire-balls like Roman candles. Nevertheless, the true nature of fire-balls is not at all well known. M. Planté has shown by experiment that they are perhaps the luminous end of a gentle discharge of current electricity passing between a charged cloud and the earth. Both observations and experiments are, however, still required to explain these mysterious vagaries.

Of late years new light has been shed upon the phenomena of thunderstorms; and there are signs of a more systematic study of their effects being instituted. Professor Schuster's recent discovery that air is, comparatively speaking, a conductor of electricity provided it be "polarized" by the passage of another electric discharge, has an important bearing on this subject, and helps to explain the length of some lightning strokes. The experiments of Threllfal on the production of ozone by electric discharges in air, confirms the common belief that lightning freshens the atmosphere; and the results of experiments in depositing dust and vapors by statical discharges from a Wimshurst machine, also strengthen the popular faith in lightning as a purifier of the air. In fact the "smuts" frequently observed when the atmosphere is dull and "thundery" may be a similar effect to what he has observed. Again, the experiments of Professor Hughes on self-induction lead to the conclusion that the best form of lightning-rod is a flat ribbon of copper, or a strand rope of copper or iron, since it has less self-induction than a round rod or wire.

It has also become clear that in order to insure protection by lightning-rods they should be periodically tested by a competent person; and Messrs. Siemens and others now supply apparatus for this purpose, together with the separate insulated wire to the lightning-rod which is necessary to complete the testing circuit. By this means the conductivity of the rod can be ascertained from time to time. Indeed, it is becoming more and more evident that lightning-rods should only be erected by skilled electricians knowing the business thoroughly, and there is some reason to think that the Board of Trade, or at least the insurance companies, should provide that lightning-rods be erected in conformity with the conditions laid down by the Lightning-Rod Committee, or, to speak more correctly, in accordance with the latest results of electrical science.

France has for some time past instituted observations on, and collected statistics of, lightning strokes. Germany has established observatories for studying the same phenomena, and at the recent meeting of the British Association at Manchester the Hon. R. Abercromby proposed a plan for the systematic study of thunderstorms. It will thus be seen that combined action is being brought to bear on this important subject. Already the Germans have discovered that low marshy lands and inlets of the sea are more frequently visited by lightning than dry uplands. There is much, however, to be found out, and the subject, besides having a peculiar interest, is both profitable and humane. — *Engineering.*

COMMUNICATIONS

EFFLORESCENCE ON FURNITURE.

BOSTON, November 22, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — Having read your publication with much pleasure and profit since its inception — although I am not one of those for whom it is specially intended, perhaps — I venture to trespass a moment upon your time, and ask you to help me out of a difficulty if possible.

For fifteen years I have devoted myself to cabinet-work in my leisure hours, much of my information being gained from professional workmen, so that now I am not afraid to undertake any sort of carving, construction or finishing. But I have met a snag, which I have also observed in the work exhibited in one of the foremost furniture houses in town. A year ago I finished with shellac an *ebonized* screen-frame and a *mahogany* picture-frame, using six coats of shellac (*bought new* at a leading store), and finished with 00 sandpaper, and finally with haircloth, oil and powdered pumice-stone, employing no alcohol to wipe dry with. So far, so good. The screen was placed in my drawing-room near a floor-register and the frame hung at the window-end of the same room. Four weeks ago I noticed for the first time a foggy, whitish-gray appearance on both these articles, and I was nonplussed, as many articles in my house, which were years ago treated the same way, are not affected at all.

Both the solvents used in the ebony and mahogany stains were water, which dried before I applied the shellac. I recently saw this unwelcome blemish in a $75-cabinet in a window in town. My inquiries have been without avail, both in stores and shops, where I have many acquaintances. I do not wish to trifle with my work, as it is too good to spoil. Can you suggest a remedy, or, at least, a prevention? You will infer that this is not an idle question from an amateur, and I am perfectly willing to pay for the advice if you can refer me to any one or give it yourselves. Respectfully yours,

W. H. D.

[WE do not find any explanation of this phenomenon, which is not an uncommon one. The indications point rather to some adulteration in the gum shellac or varnish. Unless oiled after finishing, shellac is often affected in this way when wiped with a wet cloth. — EDS. AMERICAN ARCHITECTS.]

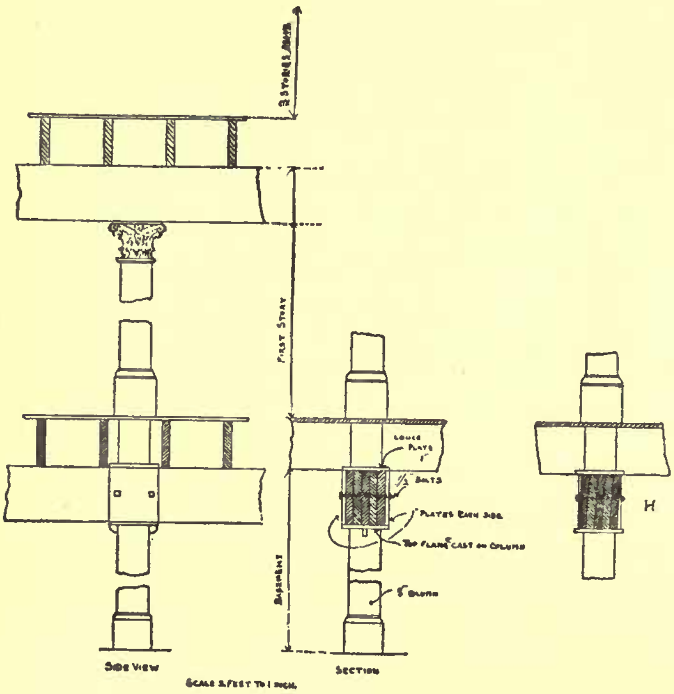
A POORLY-CONSTRUCTED FLOOR.

LOS ANGELES, CAL., October 27, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — Enclosed with this you will find a sketch showing the construction used in a large, four-story hotel building in this city, which was complained of to the Board of Public Works by the Chief of the Fire Department — there is no building superintendent here — together with the report of the Building Committee and their expert.

The block has three double stores with this construction used in each exactly as shown by this sketch. The columns carry their portion of three stories and roof above stores included between store



walls, which are some fifty feet apart. The sketch H shows the condition of the built girder in basement in many cases, and how the plates were let into the same in order to make them plumb.

The writer has a decided opinion in regard to the construction employed and its safety, but would like the opinion of the editors of the *American Architect* and any of its readers who are *C. E's.*

Yours respectfully, E. L. C.

REPORT OF BUILDING COMMITTEE.

TO THE HONORABLE THE COUNCIL OF THE CITY OF LOS ANGELES: —

Gentlemen, — Your Committee on Building beg leave to report: —

First, In the matter of the report of the Chief of the Fire Department, as Building Inspector, with regard to the building now being erected on the north-east corner of Main and Fourth streets, that your committee visited the building, in company with the Building Inspector, on the 20th inst., and were afforded every facility for investigating the strength of construction, means of escape in case of, and appliances for extinguishing fire. We found two of the iron columns in the south row in the basement slightly out of plumb. These, though not seriously, if at all, affecting the safety of the building, we advised to have set plumb. In other respects we found the structure strongly and safely built, well provided with means of escape in case of fire, and with fire-hose connections two inches in diameter on each floor and on the roof. We regard the building as creditable alike to the owner and the architect, so far as the above specified qualities are concerned.

The opinion of Mr. W. T. Lambie, C. E., employed by your committee to inspect the building as to its strength, more especially as to the setting of the iron columns, accompanies this report. The columns have been reset plumb, as advised by your committee and Building Inspector, before Lambie's examination.

J. HYANS, M. TEED, E. W. JONES, THOS. GOSS, } Building Committee.

Los Angeles, October 24, 1887.

[THIS seems to us as very dangerous construction; just how dangerous we cannot say without knowing more exactly the dimensions of the top flange of the column, the probable weights on the floors, and other details, but we should not like to stay in the building after the wooden girders had begun to shrink. — EDS. AMERICAN ARCHITECT.]

A QUESTION OF COPYRIGHT.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — I have a question of copyright on which your opinion would be of great value to me, and, no doubt, of interest to others.

"B," ignorant of architecture, but in business as an architect, employs "A" as "assistant." "B" becoming short of funds and in debt to "A" for salary, asks "A's" indulgence until he can secure a certain large piece of work. "A" objects to working longer for promises, but finally agrees to design and prepare the drawings on condition that "B," as soon as contract is signed, pays his indebtedness, and in consideration of certain other inducements which "B" offers. "A" sets to work; prepares drawings which are accepted, contracts are signed and the work commenced. "A" then calls on "B" to fulfil his agreements. "B" puts him off by promises for several months, when "A" leaves him.

"A" then has designs copyrighted.

Now, as "A" had to design and prepare the drawings without any aid from "B," and received no recompense from him, cannot "A" hold copyright, and make "B" pay royalty for the use of drawings?

Respectfully yours, S. R.

[WE should not call this a question of copyright, but one of what the lawyers call "master and servant," or of simple contract, according to what the arrangement between A and B might have been. There is no question that A could send his design and have it copyrighted, unless it were a glaring imitation of some other copyrighted design, but we do not think that he could legally take any benefit from his copyright, for the reason that any work which he had done for B, under an arrangement either for a salary or a certain agreed compensation, would belong wholly to B. If this were a real case, we should say to A that by taking the law into his own hands he had not only deprived himself of any chance for getting paid for the services he had rendered, but had rendered himself liable to pay heavy damages to B for the loss which the latter might incur through being unable to avail himself of the drawings at the time he expected to use them; as well as on account of the extra expense and time necessary for having new ones made. It cannot be too carefully kept in mind that if one party to an agreement wishes to have the other keep his promises, he must fulfil his own. For a draughtsman to accept an offer from an architect to make certain drawings, and, after the drawings are made, to copyright them so that the architect cannot use them, is a breach of faith which would certainly justify the latter in not paying for them, and in holding on to any other money that might be due the draughtsman, to go toward making good the damage occasioned by his reckless trick, a trick the less excusable in this case, as A, under the circumstances, could have made sure of payment for his work, as well as for all previous arrears, by the simple process of trusteeing the commissions which B was to receive from his new client. — EDS. AMERICAN ARCHITECT.]

SANDING GALVANIZED IRON-WORK.

SAN FRANCISCO, CAL., Nov. 21, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — Will you please inform me if it is customary in the Eastern States, to sand galvanized ironwork on the fronts of buildings.

I am told by painters here that sand will not stay on galvanized iron, but will come off in flakes; the galvanized-iron men tell me it is done almost always in the East.

I cannot see why the sand should not stay on, as the paint never chips, nor cracks when not sanded. Yours very respectfully,

C. R. WILSON.

[IT is usual to sand galvanized ironwork in New York, and in other places where it is used in connection with freestone. In our experience, the sanded paint clings quite as well as the unsanded to the metal. — EDS. AMERICAN ARCHITECT.]

NOTES AND CLIPPINGS

RAILROAD SNOW-SHEDS. — Snow-sheds to cover the railway track have been built at points on the Central Pacific road where it crosses the Sierra. As the trains bound East leave Emigrant Gap they run through one continuous shed for 35 miles. The purpose of the sheds is to prevent the track being buried under falling and drifting snow. They secure this end, but are themselves the occasion of great inconvenience, such as the noise, the loss of view, and confining of the smoke to the train. There is nothing peculiar in the construction of these sheds, which have to support only the burden of the snow. But on the line of the Canadian Pacific, where the road crosses the Rocky Mountains, sheds of a different construction are needed. Before the road was completed observations in the mountains showed that avalanches must be provided against. A single avalanche covered the track for a distance of 1,300 feet, and to a depth of 50 feet. The result of these observations was that the company built 4 1-2 miles of snow-sheds at an enormous expense. The sheds are constructed as follows: On the high side of the mountain slope a crib filled with stones is constructed. Along the entire length of the shed and on the opposite side of the track a timber trestle is erected; strong timber beams are laid from the top of the crib-work to the top of the trestle, four feet apart, and at an angle representing the slope of the mountain as nearly as possible. These are covered over with four-inch planking, and the beams are braced on either side from the trestle and from the crib. The covering is placed at such a height as to give 21 feet headway from the under side of the beam to the centre of the track. The longest of these sheds is 3,700 feet. — *Truckee (Nev.) Republican.*

FIREPROOF CURTAINS IN THEATRES. — Fires in theatres generally commence behind the curtain, and the audience lose their lives in trying to escape from the building before the fire can spread into the front of

the house. If they were perfectly assured that the opening in the proscenium-wall could be closed and the fire confined behind it, they would walk out in an orderly manner, and two ends would be gained: first, there would be no loss of life, and second, the destruction of property would often be reduced. It is strange that with all the regulations and inspections by Boards of Works and by Justices of the Peace, the simple and effectual precaution of a fireproof shutter or curtain capable of closing the proscenium has never been insisted upon as essential. The architect of the Prince of Wales's Theatre (formerly the Prince's) put in a well-designed iron shutter on his own initiative, and there is no doubt that the assurance it gives to the audience, who see it raised and lowered every evening, has been one of the causes of the full houses which have been obtained since the Exeter disaster. Unfortunately, structural considerations prevent the adoption of hydraulically-worked iron shutters at most theatres, and protection has to be sought by simpler means. At the Queen's Theatre, Manchester, an iron-framed asbestos curtain is used, manufactured by the United Asbestos Company, Limited, of Queen Victoria Street, E. C. This consists of a channel-iron frame, with vertical and horizontal bars, held together by cross-bracing, and covered with specially-thick asbestos cloth. The shutter is counterweighted, and runs between guides fixed to the inner side of the proscenium-wall. It is raised by being drawn upwards above the proscenium-opening. Terry's Theatre has a modified form of this curtain, which can be made in different ways according to circumstances. The best plan is to cover both sides of the frame with cloth, leaving an air-space of two or three inches between the two surfaces. In low-roofed theatres, the lower part of the shutter must be hinged to the upper in order that it may be folded up out of sight. A curtain of this kind would probably keep the fire back as long as an iron one of the same general design, but it would not be as effectual in preventing panic, for the public would not put so much faith in it. Further, as it has to be worked by hand, there is a temptation to keep it as light as possible, and thus to decrease the strength of the barrier between the audience and the flames. But as we cannot expect to get framed iron curtains in existing theatres, let us have them of asbestos, which is infinitely preferable to the coiled-iron corrugated shutter which is being introduced. In the United States, the sprinkler-system has been applied in some theatres in such a way that in the event of fire, a sheet of water is discharged from the top of the proscenium, cutting off the burning portion of the building from the auditorium. — *Engineering.*

"Water-hammer" Action in Steam-Pipes a Source of Danger. — On Tuesday, the 25th ult., a fatal explosion occurred at Messrs. Listers' Manningham Silk Mills, near Bradford, from the bursting of a stop-valve in a range of steam-pipes. From what can be learned, it appears that, in consequence of the drain-tap not having acted properly, a quantity of condensed water had accumulated in the pipe, and when the engineman came to open the stop-valve, the water was driven forward with such violence by the rush of steam that the upper portion of the valve was blown off and the engineman so severely scalded that he died a few hours afterwards. Several fatal explosions have recently been recorded from the bursting of steam-pipes in consequence of water having been allowed to accumulate in them, and the great importance of keeping the drain-taps open, or, better still, if possible, of so arranging the pipes that water cannot accumulate in them, is not so well understood by boiler-attendants or steam-users generally as is desirable. Some very pertinent remarks on the subject were made by Mr. Peacock, the President of the Manchester Steam-Users' Association, in the course of his address at the recent annual meeting of the Association. Alluding to a very similar case, which had occurred just previously, he said the "water-hammer" action which occasionally occurred in steam-pipes, was of considerable practical importance. As an illustration, he referred to the violent vibration and noise occasionally observed in the tenders of locomotives when standing at railway-stations owing to the driver turning his surplus steam into the feed-tank. This was caused by the rapid condensation of the steam, and, although not precisely similar to the action which occurred in steam-pipes, it served to give an idea of the forces which were in operation. The bursting of steam-pipes from "water-hammer" action was, he said, "by no means infrequent, and could only be avoided by preventing all accumulation of water therein. Should there be any dip in the pipe that rendered the accumulation of water possible, a drain-tap should be fixed thereto and kept open constantly. The water should not be allowed to accumulate and then be suddenly discharged, but the tap should be kept slightly open so as to prevent any accumulation whatever." We may add that we can fully indorse the importance of this recommendation, for we have met with cases in which the attempt to drain off by means of a drain-tap a long, horizontal length of pipe, which had been allowed to get full of condensed water, resulted in such violent "water-hammer" action that the pipe was shivered to pieces. — *Engineering.*

Layard the Explorer. — The following extract from a letter from Lord Strangford, written in 1846 (in "*Lives of the Lords Strangford,*" by Fonblanque, p. 257), is of interest: "My principal friend here is a man of the name of Layard, whose history is somewhat romantic. Some years ago, being int he Company's service, he arrived here on his way out. Here he foregathered with a countryman, and these young Delhis started off on foot, with a compass, to see the world. They arrived at Bagdad; one went by the Persian Gulf to Bombay; Layard disappeared, and about three years after reappeared in the ambassador's palace here. He had wandered on foot and alone through the wildest part of Kurdistan and South Persia, and walked back again when tired, in the guise of a Kurd or Arab or some such wild animal. . . . His great passion is ancient and Oriental geography; he is a fair scholar, well up in Herodotus, and a great rooter out of antiquities. . . . He has been all last year at Mossul in the thick of the cholera. His workmen used to die by cartloads. I never spent so pleasant a month as this last, while he was living with me and Hughes. He is a very remarkable man, of the most prodigious knowledge, not of books, but of men, gained by ten years' travel between the Danube and the Indus, without a penny in his pocket, and rising daily without knowing where he would sleep, with his very life hourly in danger. To all this he adds a most correct judgment, much reading and many accomplishments."

Statues raised in France. — Since the establishment of the French Republic, about two hundred statues have been raised in France. This ought to satisfy "the decorated people living in a country of statues," but a proposal has been made for monument-raising on so gigantic a scale that it throws all their previous efforts to commemorate their national greatness and flatter the national vanity completely into the shade. There exist, it seems, two rival committees working for the celebration of the centenary of the Revolution two years hence, but, as Minister of Public Works, M. de Hérédia thinks he is entitled to make a proposal on his own account. Not content with the proposed monumental museum in the Tuileries or the colossal Eiffel Tower, he has calmly suggested to a Ministerial Council that a commemorative monument or column of the Revolution should be erected in every commune in France! As this would mean some 40,000 monuments at one stroke, the Ministers, accustomed as they are to the perpetuation after this manner of the glories of the "*grande nation,*" asked time to consider this extraordinary proposal. — *Pall Mall Gazette.*

TRADE SURVEYS

The strongest assurance against a reaction in business circles within a year or two is to be found in the fact that nearly all great industrial operations are in strong hands. Railroad construction and manufacturing operations, as well as land speculations and mining operations, are all conducted by capitalists and syndicates who know what they are doing and who have entered into these operations, calculating upon more or less depression or reaction. Should a depression come they will simply hold on and wait. They will not be obliged, like their predecessors in times of disaster, to sell out and throw their property to the dogs. Having bought land, mineral, timber, machinery, building-material, etc., at low prices, and having invested their money when the rate of interest was low, they feel quite safe in their position. They know, also, that it is only a question of time when a reaction will set in and that an advance in values will eventually take place. America must of necessity be peopled rapidly by foreigners, and this, with the natural growth of population, will create, in the long run, a steady demand for land and its products, for machinery-manufactured products of all kinds, and transportation. They, therefore, feel that it is not only safe but that it is advisable to make the extraordinary purchases and investments at this time. Their efforts must advance real estate, and if one railroad company will not penetrate a new region, another will. It is just this which has done much of the railroad-building, and this is the reason why the standards for railroad-building, which have hitherto prevailed, cannot apply in the future. It is evident that railroad-building in the South and Southwest will be pushed along. The Illinois Central, it is announced, will construct a line from Cairo to Memphis and will add some branches and connections in the South, which will make it a very heavy buyer of everything which goes into railroad construction. Mention is made of several other railroad systems centring at Chicago and St. Louis, which contemplate vast extensions throughout Nebraska, Indian Territory and Texas. This territory will be supplied with railroad facilities, and the investors will wait until the country grows up to it. There is nothing of importance in the steel-rail market apart from the fact that sales since December 1st, so far as reported, foot up about 100,000 tons, but all sales are not reported. Prices are $33 at mill and it is said that this will be the bottom figure at which all large buyers who are now negotiating will be obliged to come in. All branches of the iron trade are in vigorous activity and prices are firm, excepting in nails. The nail-makers are having a severe struggle against over-producing capacity, and perhaps not over 45 per cent of the nail-capacity of the country is at this time engaged. Prices have declined to $2 per keg and less. The heavy crude-iron production is all absorbed, or practically so. In the lumber market a moderate volume of business is being done and prices are stationary. Heavy operations are being drawn to a close, and preparations are being made for active logging operations throughout the Northwest. The demand for yellow pine will in all probability be 25 per cent greater next year than this, although some will be inclined to doubt whether this great increase can be made. A speculation is going on in yellow-pine lands, but no general advance in values will take place within the next twelve months. Architects in New York, Philadelphia and Chicago make very encouraging statements this week regarding the prospects for winter and spring work. A great deal of heavy building is projected in those States as well as in others. Railway-terminal facilities will be extended. A great deal of warehouse room is wanted. Besides this, a great many public buildings and Government buildings will be erected. The coal strike is occupying less public attention owing to the easing up of general demand. Prices are high and the production is about 730,000 tons per week. The bituminous output is very heavy and all buyers are able to secure sufficient to keep their furnaces running. Railroad companies are liberally supplied and domestic requirements are more promptly filled. The builders throughout the country are closing up the year's accounts with a good deal of satisfaction. Plans for the coming year have not been completed very generally, but enough is known to show that a great deal of building will be undertaken as soon as the weather permits throughout the North and that a large amount of work will be pushed along in the Southern States during the winter. It does not appear that there will be much change in the prices of building material. Brick will probably open a little lower than last spring, owing to the purpose of manufacturers to increase the supply as much as possible. Slate will rule a little lower, owing to the heavier production contemplated. Composition material of all kinds will be also a little easier for the same reason. Planing-mill material is now low enough and the combination is endeavoring to advance prices. Lumber will, likely, open strong and continue firm until some unexpected influences will turn prices downward. Lumber combinations are not of sufficient strength or extent to interfere seriously with competition. An immense amount of yellow pine will be thrown into Northern and Western markets. The consumption of hard wood will also be very heavy, and hard-wood dealers in the large Eastern markets state that they will make heavy purchases or contracts this winter for spring and summer requirements. The financial situation is as gratifying as could be expected. Failures continue few in number and the credit of the country is in excellent shape.

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CONTENTS

WE learn with much regret of the death, at the early age of twenty-four, of Mr. James S. Trowbridge, of Cincinnati, one of the most conspicuous among the young architects of a city which is second to none in the ability and enthusiasm with which our profession is practised. Mr. Trowbridge, after his school-days in Cincinnati were over, entered the office of Mr. Edwin Anderson, and, under his kind care, rapidly advanced in the art which he had chosen, and had attained remarkable skill as a draughtsman, as well as an intelligent comprehension of ordinary construction, before entering the Massachusetts Institute of Technology for a finishing course. On completing this, after staying in Cincinnati for a few months, he sailed for Europe, where he spent a year in sketching and study, and on his return soon found himself busily engaged in the practice of the profession for which he had equipped himself so thoroughly. In the midst of his work he was seized with typhoid fever, and died just as the most brilliant professional prospects had opened before him. It is not for us to question the will of Providence, or to set temporal affairs against the purposes of eternity, but we must at least, while rejoicing that there are so many others of similar character left to us, mourn deeply the loss of one so well fitted to lead among the faithful, sober and accomplished young men to whom is entrusted the future of American art.

A CURIOUS point of law is reported to us by the kindness of the architects interested. Some time ago these gentlemen were commissioned to draw plans for a skating-rink, and a contract was made with a local builder to erect it complete within two months, under forfeiture of one hundred dollars for every day's delay. The building was completed at the appointed time, but with certain defects in the shape of omissions and inferior work, which the architects refused to accept or to certify for. The owners took possession of the building, however, and occupied it for some months, when it was destroyed by fire. The contractor then brought suit for the unpaid balance of the contract price. The case was, by consent of the parties, decided by a referee, Judge Edwards, of Broome County, New York, who found that no certificate had, as the contract required, been given for the balance claimed; that the architects, in refusing the certificate, had acted in good faith and without collusion with the owners, and that the condition of the building warranted their refusal; that the building might have been constructed within the allotted time in substantial conformity with the plans and specifications, but was not so constructed, and that the omissions and defects were material deviations from the contract, and were intentional on the part of the builder; and he decided that the latter was "not entitled to recover in this action any part of the amount remaining unpaid upon the written contract, being the payment of thirty-one hundred and fifty dollars agreed therein to be paid him by the defendants when the work contracted for was finished and accepted by the architects by their written acceptance."

THE way of the walking-delegate in New York appears to be getting somewhat less comfortable than it has hitherto been. The great dealers in materials, who were savagely boycotted because they sold goods to another dealer, who sold other goods to some one else, whom the delegates did not like, are determined to prevent similar attacks on their business for the future by proceeding to the extremity of the law against their assailants; and other sufferers, encouraged by the attitude of the great wholesale dealers, are having their cases prepared for the courts. Meanwhile, the antics of the labor tyrants are attracting the attention of the Grand Jury, as well as of the civil courts, and an indictment for conspiracy has just been found against the Executive Committee of District Assembly 91. Some months ago the foreman of a shoe factory thought it his duty to discharge a member of this Assembly. The Executive Committee, with characteristic insolence, went to the proprietors of the factory, and demanded that their man should be reinstated, and the foreman discharged. This modest demand was refused, and the factory was struck. The proprietors held out for a time, but at last, rather than be ruined, yielded, and sent the foreman away, reinstating at the same time the man whose conduct originally caused the trouble. The Executive Committee of this man's assembly then began a systematic persecution of the foreman, chasing him out of successive shops, until he removed to Newburgh, sixty miles from New York, and engaged himself to a firm there, only to be notified, before he began his work, that the firm withdrew from its agreement, from fear of trouble with the Unions if it employed him. It is much to be hoped that a final stop will be put by means of this case to the practice of allowing irresponsible committees to amuse themselves by hunting men with families into poverty and starvation, for the sake of showing their own importance. For the benefit of those who like to nip such tyranny in the bud, we will mention a little story which we find in the *Sanitary Plumber*. According to this journal a walking-delegate, with his silk hat badly mashed, and his clothes bereft of their usual gloss, came into court the other day, and demanded satisfaction for an assault which, as he said, had been made upon him by the foreman of a Third Avenue factory. According to his story, he entered the factory, and told the foreman that he wished to explain something to him about the grievances of the men. The foreman declared that he did not want any explanations, and, when the delegate insisted upon making some, cut them short by seizing him by the neck and pitching him into the street, greatly to the detriment of his apparel. The judge listened attentively to the delegate's tale, and then informed him that the foreman did perfectly right, and that his complaint was dismissed.

THE Nicaragua Canal enterprise seems to be fairly launched, under excellent auspices, and Mr. Menocal's years of skilful labor are likely at last to bear some fruit. According to the careful estimates now presented, the canal which is to be finally staked out by the party which sailed from New York in the steamer "*Hondo*" last month, will cost less than sixty-five million dollars, and will offer a safe and easy passage from the Atlantic to the Pacific. Every one knows the peculiar topography of Nicaragua, by which the lake of Nicaragua, one hundred and ten feet above the sea, with the rivers flowing into and from it, are to be utilized as the principal part of the canal, leaving only forty miles of excavation to be done. So far as the United States is concerned, the Nicaragua route is probably preferable, the distance through it between the Atlantic and Pacific States being much less than by way of Panama; and there seems to be no reason why it should not be equally favorable for vessels steering from Liverpool or Genoa for China and Australia; so that the main obstacle to the speedy construction and profitable utilization of the canal appears to lie in the competition of the Panama and Tehuantepec routes. The latter seems for the present to be abandoned, but the Panama enterprise, notwithstanding all that is said about it, seems to have plenty of vitality left. For a time, the newspapers were full of predictions of its speedy collapse, and of

rumors of the reduction of the working force, and other alarming things; but within a few days Mr. Slavin, of San Francisco, the principal contractor for the work, has informed the reporters of the New York papers that the excavation is half done, that the Canal Company has plenty of money in its treasury, and that the work will unquestionably be carried out. Some of the reporters seem to have learned for the first time from him that the project of a sea-level canal had been abandoned, and that several locks were to be introduced, to diminish the amount of excavation; but the fact is that this change was made something like two years ago, and that the work has been proceeding on that plan ever since. It is certainly unfortunate that two rival companies should be spending such enormous sums of money on the same work. Whatever may be the traffic between the two oceans, it is not likely to be large enough to pay more than a fair dividend on the cost of one canal, and to set two companies competing for it is a sure way to ruin the stockholders of both. In a recent book, Mr. Laurence Oliphant, in speaking of a visit which he once made to the Isthmus, mentions a valley intersecting the middle range of hills, which presented a pass so little elevated above tide-water that the Indians were accustomed to haul their canoes from sea to sea through it. Of course, if such a valley as this could be discovered at Panama, the problem of a sea-level canal would be solved, and the fearful task of cutting through the Culebra hill, with the little less difficult one of damming the River Chagres, would become needless; so that, if Mr. Oliphant had really any foundation for his statements, Mr. Menocal might perhaps with advantage take his surveying party in search of this route, and, if he found it, share the advantage of his discovery with the Panama Company.

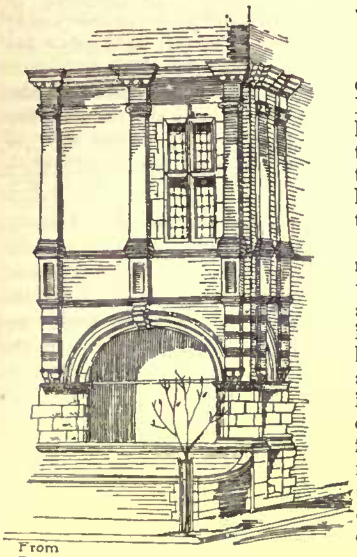
SOME curious observations have been made recently in Saint Petersburg in regard to the influence of the electric-light upon plants. It was observed long ago that flowers and plants used as decorations for the evening in rooms illuminated with electric arc-lights preserved their freshness much better through the evening than in rooms lighted with gas or candles; and one of the Siemens brothers made some experiments with electric-light in a greenhouse, from which he found that plants would grow at night under such circumstances. Later, a similar experiment was carried out on a large scale, a greenhouse being brilliantly lighted by electricity every night for some months; but the result was disastrous to the plants. Although they grew rapidly in some cases, the growth was soft and unhealthy; no flowers came, and the over-developed plants one by one died of mildew or decay. Last year the electric-light was introduced into the Winter Palace at Saint Petersburg, and with Russian luxury, a profusion of lamps was scattered through the great reception-rooms, filling them with a blaze of light. During the season, the principal rooms are decorated with hundreds of plants, palms, camellias, laurels and roses, which are usually kept there through the winter. Under the influence of the electric-light, however, all the plants began to show signs of suffering in a few days after they were set in place. The leaves turned yellow, and dropped off in showers, in some cases showing black, burnt spots like those often seen on leaves exposed too suddenly to a hot sun. The effect in general was like that which would follow from suddenly removing the shading in midsummer from a greenhouse full of plants, and many of them died outright, while others were so much injured that it will be years before they recover. Although it is probable that the dryness of the atmosphere in a Russian house in winter had something to do with the effect, the important part played by the electric-light was demonstrated by the fact that some of the plants, which stood in niches, sheltered from the direct rays, were not injured.

MANY architects, as well as farmers, will rejoice at the decision of the United States Supreme Court, which declares the patent of Nelson W. Green, for the process of drawing water from the earth by driving a tube down to the water-bearing stratum, to be invalid. The basis of the decision is the fact, proved by evidence, that driven wells of this kind were in use in New York State two years before the date of Colonel Green's patent. As everybody who took any interest in the subject knew years ago that driven wells by the score had been sunk before the date of the Green patent, and that the patent was for that reason invalid, we imagine that the most conspicuous result of the decision will be the calling of public attention very forcibly to the disgraceful delays of justice which have become characteristic of this country. Ever since the issue of the patent, which never had any validity, and which a great many people must have known at the time to be worthless, the patentee and his representatives have been collecting royalties at exorbitant rates, on driven wells all over the country, and have, in the fifteen years which have elapsed between the granting of the invalid patent and the final declaration of its invalidity, amassed fortunes, which, under the law, they are not required to refund to those who have paid them money on a claim well known to be worthless. As the patent would have expired in a year or two, the moral of the story, which will not be lost on unscrupulous persons, is that an invalid patent, once granted, is just about as good for extracting money from the community as a valid one, and that, as the Patent Office examiners could not, even if they were not expected to leave that office to the courts, inquire into the originality of every device submitted to them, an earlier invention, which has not been patented, may be boldly appropriated, and, in the face of overwhelming testimony as to its previous use, be employed to collect tribute at discretion during the years which must elapse before an end can legally be put to the imposition.

FOR some reason, perhaps on account of the climate, or possibly because the Danish colonists on the east coast of England were more unruly than the Celtic Britons who had gradually been driven to the western part of the island, the western half of England seems to have been the most popular place of residence with the Roman masters of the country, and Roman remains, with Roman names, are found much more frequently on and near the Welsh border than elsewhere in Britain. At best the position of the Romans in the island seems to have been more like that of the French in Tonquin perhaps, or of the Belgians in Africa, than that of permanent settlers, so that the evidences of comfortable occupation are not very numerous, but in this district are occasionally found the remains of a villa, perhaps the residence of some official. One of the most complete of these yet discovered has just been found at Tockington, near Gloucester. Last year a laborer, who was at work digging a trench for the foundation of an enclosure for cattle at a farm, turned up with his spade some curious little stones of different colors. He put them in his pocket as curiosities, and showed them later to the steward of the estate, who at once recognized them as Roman tesseræ. At his suggestion, further excavations were made, and a beautiful Roman pavement exposed to view. The news of this discovery was communicated to the Bristol and Gloucestershire Antiquarian Society, which, with the consent of the lessee of the farm, commenced systematic explorations. Trenches were dug in parallel lines over the ground, and the walls of an extensive villa exposed, and it was further discovered that the present group of farm-buildings, which were arranged with a rectangularity not very common on English farms, occupied the site of a portion of the antique villa, so that the Roman masonry, still showing its characteristic construction, served as the lower portion of the walls of the modern buildings. As exposed by the excavations, the ancient structure had twenty-three rooms on the ground floor, six or seven of which still retain their beautiful inlaid pavements, of pieces of white and gray stone, mixed with bits of brick, cut to the shape required for the pattern. These pavements were laid upon a network of flues, forming the hypocaust generally used by the Romans in Britain for warming their rooms, and, in addition to this, terra-cotta pipes were found built into the walls, through which hot air was conducted to the rooms in the upper stories, in just the way that such pipes are still used in Paris. The condition of the walls, together with traces of charred wood found in various places, showed that the ancient buildings had been destroyed by fire, but portions of the roof-covering were found, consisting of large slates, two feet long and an inch thick, together with a few flanged terra-cotta tiles, which may have been used in repairs; and some of the plaster which covered the walls was found with remains of painted decoration still adhering to it. So far nothing has been discovered in the building in the way of portable property except some Samian pottery, a brass coin of one of the Roman governors, and an iron strigil; but, according to the *Builder*, from which we borrow the account, the work of exploration is to be continued, and further interesting discoveries may be made.

ART IN THE MODERN HABITATION.

ROME, November 12, 1887.



From
A New House in Queens Gate.
R. Norman Shaw. R.A. Archt

UNDER this title M. Lucien Magne, an architect of Paris, held at the Library of the Union Centrale des Arts Decoratifs a conference, which has already made on this side of the Alps a certain stir amongst that class of architects who follow with a lively interest the artistic movement in France.

The publishing-house of Firmin-Didot of Paris has printed with great elegance the doings at that conference, and to render it more intelligible the author has added numerous illustrations, as much for the sake of supporting the examples of modern architecture which he cites, as to furnish documentary evidence for that portion of his work consecrated to an historical *résumé* of art. This latter portion is certainly most curious reading, although, relating to our epoch, it offers a more immediate interest to us. But that which renders this conference worthy of the greatest praise is that, in spite of the thoroughly aristocratic luxury with which the book is bound and printed, it has a popularizing aim which is perfectly in conformity with the democratic tendencies of the epoch in which we live.

M. Magne rightly undertakes to refute the doctrine that art is confounded with luxury and only has an interest for the élite of society. He sets himself to prove that it is within the reach of everybody, that it ought to impress itself on every manifestation of social life, and that if it does not, this is because of an error of definition as much as of a vice of education. To successfully refute this, it is naturally necessary to overthrow certain prejudices as to abstract conceptions of art. Classic beauty so-called, for instance, is only a sham. Every work which is carried out under conditions of decorative elegance and which favors the rational employment of the material so as to give satisfaction to an idea or a need is a work of art. This is equivalent to saying that the line drawn up to the present time between the fine arts and the industrial arts has no reason for its existence. It is especially in architecture that work is generally the simultaneous interpretation of an idea and of utility. In the temple, the symbol expresses the idea, and the nave corresponds with the need. This does not prevent the Parthenon and Nôtre Dame de Paris from being works of art, with as good a claim to the title as the monument of Lysicrates or the Arc de Triomphe Starting from this, we can affirm that art has its place in all objects destined to the most ordinary of everyday uses, and this was to be seen, moreover, in the heyday of the gold-maker's art, when the tables glittered with candelabra and ladles which were pure *chefs-d'œuvre*. Among the Etruscans, even, the elegance of form and the love of decoration were apparent in the meanest of domestic utensils.

The study of ancient civilizations is necessary, then, for modern artists, because it permits them to understand what applications the resources of art allowed in antiquity, and from amongst these applications to reject those which are no longer in harmony with present customs, and to retain, on the other hand, those which are susceptible of advantageous adaptation to the needs of to-day. It is particularly in the study of the dwelling-house that the artist, and particularly the architect, can find precious indications as to the kind of civilization which prevailed amongst the ancient peoples. Nothing serves as the planning of a house to characterize the customs, the tastes, and even the sentiments of those who inhabited it. A Grecian house, of which only poets and historians have left us descriptions, evokes to our eyes through its intelligent distribution the image of the man who belonged before everything to the city, and who hardly allowed his family relaxations to pass beyond the sill of his gynæcium. The spacious atrium of the Roman house shows us a habitation whose owner rested his credit upon a numerous band of clients, and Pompeii, which — new phœnix — is born again from its ashes, revivifies for us this population of epicureans who led a life of pleasure, but who knew how to add to all forms of delights all kinds of graces. We discover here in the general lines of the architecture, as well as in the decoration, the delicate taste of Greek artists who had come in great numbers to these smiling shores; while at Rome, even, the delicate influences of Hellenic art mixed with that of ancient Etruria, more robust, more masculine, to form a style with two phases in which one easily discovers the traces of its different origins.

In the last centuries of the empire, the vast dependences of the Roman house declare the opulence and pride of the aristocracy, which, absorbed by public affairs, left to slaves almost the entire charge of the house; but later, when the triumph of Christianity had enfranchised the oppressed classes, the habitations took on a new character, which, nevertheless, remains vague and indefinite for a long time.

It is only toward the end of the eleventh century that society aspired to elevate itself, to know itself, and from that time its domestic architecture begins to claim our attention. There remain few specimens of this epoch; but from what we can see of it, we seem to recognize in the new organization that domestic life has taken a more important place. We already find in the centre of the apartment the *salon* devoted to the common gathering. We find under different latitudes similar forms of decoration, which reveal amongst peoples widely separated an identity of origin. How can we pass over in silence the striking analogy which exists between the ancient houses of Cluny and those of Viterbo, both of which antedate the twelfth century. Setting aside some differences in the disposition and decoration, differences which are justified by the different climates, we see that these dwellings, so widely separated from one another, are derived from the same style. At Viterbo the rooms receive light through windows which look on an interior court-yard. This is because here, under a burning sun, it is necessary to provide for a cool and agreeable outlook. We discover in like manner mosaics and mural paintings such as we saw at Pompeii, where the Greeks had introduced them, and which were derived originally from the Orient, for the employment of vivid colors, so glaring under gray skies, is almost a necessity in a country where the neutral tones make a most poverty-stricken contrast with the splendors of the ambient light. In Italy it is necessary to protect the rooms from the sun and heat; in France, on the contrary, to shelter them from the cold and rain. This is why the staircase, which at Viterbo opens on the street, here opens, on the contrary, into a court-yard, and wherefore up to the end of the eighteenth century, the fireplace held the place of honor in every house however cut up, and took on a monumental air in those where a spirit of luxury had the ascendant.

In the productions of French art at this time we notice the application of the law already cited, which declares that art, so far as concerns architecture, shall be the result of a need. In Greece where the columns ordinarily support only one story, the lightly-loaded capitals sustain the architrave or lintel, which in its turn distributes upon the columns the weight of the roof. In French art, superposition of stories gives birth to the arch, which has the air of being an ornamental device while in reality it represents a necessity of construction. At the same time differences in climate engender variety of needs. In the North, under a rainy sky, the walls are pierced by numerous openings to admit the light. The roofs are pitched at sharp angles so as to prevent deposit of snow and facilitate the flow of rainwater. Next came the gable, which, pierced with windows like the façades, often became a subject for ornamental treatment. The types of this class of house are still visible at Provins, at Vitteau, at Charlieu, and at St. Antonin. In the South we find, on the other hand, examples of buildings with roofs which project for the sake of producing a shadow over the façade and through the interior.

Almost always French architecture of the centuries which we have just mentioned has created monumental structures to which several buildings still bear witness, such as the House of Figeac, designed by Verdier; the House of the Musicians, at Rheims, whose upper story still bears statues which will stand comparison with the most beautiful of antique statues, and those not less remarkably preserved in the little city of Cordes, in Languedoc, where the Counts of Toulouse were wont to pass the summer. The house of Jacques Cœur, built in the reign of Charles VII, at Bourges, must not be omitted. Here we can criticise the extreme exuberance of the decoration; but then, we have already reached the fifteenth century: the manners are already softened, the dwellings are safer, and elegance takes the place of the accessories which were formerly consecrated to security. Openings are multiplied, and wood admirably answers for the new necessities of the dwelling. From the fourteenth century on we see façades built entirely of wood. In the centre of France we can still admire remarkable houses of this type entirely built of half-timber work, the panels being formed of combinations of brick, as at Lisieux; of tiles, as at Beauvais; of sculptured slabs of stone, as at Angers; or simply of a rough-cast of lime mortar.

Finally, we reach, at the end of the war with Italy, the epoch when French art allowed itself to be influenced by a reflection of foreign civilization. It at first borrows from foreign masters only the forms, mouldings and ornaments, but still preserves its own leading lines of structure; in spite of this invasion, it has still managed to preserve its own character: the Hôtel de Pincé at Angers, built in 1535 by Jean De l'Espine, gives evidence of this. This monument, still standing, bears witness that in the first half of the sixteenth century the national taste had not allowed itself to be overwhelmed by the mania for Italianism. It is only in the seventeenth century when the absolute power of the king centralized everything, the administration, politics, and also, alas, instruction, that the French building is almost entirely despoiled of its original character.

Paris still possesses on the Ile St. Louis a magnificent hôtel built by Le Van in the reign of Louis XIV, which bears in its design the undeniable marks of this degeneration; but it is especially in the following century that the route becomes complete. It is to the eighteenth century that the French architecture owes the plaster-ceiling, which, it is true, conceals the defects in the woodwork, but which replaces by a smooth commonplace surface those combinations

of beams and joists of so much use in decoration. It is to this same century that we owe the white-and gold *salon*,—*baroque* and *rococo*, the too-narrow fireplaces whence the smoke escapes into the rooms, and finally the flat roofs and ill-designed gutters which deluge the ceilings and the walls with rainwater. We detect in the interior arrangements of the rooms traces of that effeminate and gallant society, where the life of the boudoir supplants the family life, and where stock-jobbing replaces honest and fruitful labor; where Nature no longer sees herself save in artificial gardens as at Versailles: these houses were quite worthy of an epoch when national honor practised a jeering philosophy, and when Voltaire, who angered Frederick the Great, took the trouble to insult the memory of Joan of Arc. Here is another instance of the way in which a revolution in morals and manners has produced a revolution in architecture. To-day the influence of custom upon art is stronger than ever. Under the Revolution, which rendered every citizen equal before the law, public wealth found itself better distributed, and every one sought in his own way a sufficient measure of elegant well-being. Even in houses of several stories every apartment is arranged like a little hôtel, offering all the desirable conveniences, vestibule, *salon*, dining-room, dwelling-rooms and rooms for servants. The humblest bourgeois of our time would blush to dwell in the inconvenient rooms of the most beautiful hôtel of the last century.

Unfortunately this love of luxury, of comfort, which might exercise a salutary influence on the art of construction by modifying the style, and by generalizing the application of the laws of æsthetics is complicated by a deplorable taste for "antiquities," so that modern taste is corrupted in its turn by association with historical reminiscences of the most dissimilar kind. We dream of bringing together in the same building a Pompeiian portico, a Henri Deux dining-room, a Louis Quatorze *salon*, a Louis Quinze boudoir. And as the methods at the disposal of our builders are changed, we can no longer reproduce these curiosities with the *cachet* which belongs to them, so that the incoherence of these reproductions is magnified by the defects of their execution. Beams are made of pasteboard, the monumental fireplace not having been built when the wall was built, its throat is too narrow and the smoke is not drawn up. Besides, in order to escape crushing the too feeble flooring, the fireplace is reduced to a simple arrangement of wood or iron clothed with plaster, but painted and gilded. Marbles are made of stucco, sculpture is pastry-work and windows are of transparent paper. This is what to-day is called art in the house.

Now is it true, as they say, that our time has no style? M. Magne believes, on the contrary, that it would be easy to reach the determination of a kind of construction which would properly characterize our time. For this it would first be necessary, according to him, to reduce the instruction in art to a small number of very simple rules, which should always be observed. To demonstrate that such instruction is possible, he himself formulates these laws by defining successively the lawful employments, so to speak, of the principal materials, such as stone, brick, terra-cotta, wood, wrought-iron, glass and painting. On this point we no longer agree with him. We have only a slight confidence in the efficacy of academic teaching of æsthetics. We comprehend scientific instruction which teaches what we call the technics of architecture; but it must be allowed to the artist to make innovations, to improvise, to step outside the limits of the commonplace; and how could this be the case when the preëstablished laws indicated beforehand the places assigned to the different materials in the buildings of the future. This reservation made, we must allow that the author has manifested in this part of his work an undeniable knowledge of all the difficulties and all the resources of architecture. For instance, for the last word as to the proportions of the dwelling, he has discovered a demonstration whose justness cannot be disputed. The house, made for the use of man, must have man for its scale of proportion. The human scale is a surer rule than the module of Vignola. From this law arises this conclusion, that the area and height of the rooms must be determined by the use to which the rooms are to be put. How many errors would be avoided if this simple rule were observed. Is it not useless to adapt the same height for the passage-ways as for a ball-room? Up to the sixteenth century French architecture gave to each room a height adapted to its use. This was one of the secrets of its originality. This law was only abandoned at a later period when everything was sacrificed to the exigencies of a false display.

We can hardly follow the author in the minute and learned study which he makes of the rational employment of materials. This would lead us to making a complete bibliography, which is not part of our project. Those who desire to thoroughly understand the ideas which he has developed on this subject, and which he supports by examples drawn from the most sumptuous buildings erected in Paris by modern architects, will have no difficulty in procuring the book of which we speak.

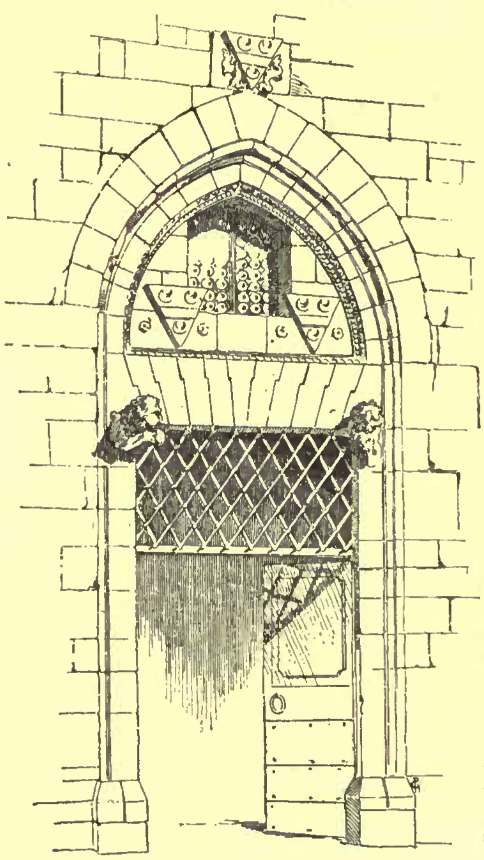
We will content ourselves with citing the conclusions of this conference which have a real importance. In the opinion of M. Magne the general laws which regulate architecture are imposed on all the industrial arts. Architecture is, then, the necessary base of instruction for all the arts, because it is the common ground for all the efforts which have a share in the execution of art-work. The lack of uniformity and of *ensemble* in industrial instruction creates certain regrettable inconveniences in practice. Every one pushes to excess the theory of the distribution of work, and plays his part without taking any regard for his neighbor, and the results are distressing discords. The joiner takes no thought for the locksmith, and neither one nor the other thinks of the mason. The result is that the masonry must be changed to receive the window-frames, and chases must be cut in the wood to admit the trimmings. If the school of design obeyed harmonious principles, the different pieces would adapt themselves to each other without struggle and weakening one another as they now do.

This general education ought to begin at school where, with the elements of designing, the pupils would be inoculated with the elementary notions of the arts which depend on it, not in view of abstract form, but in view of general combinations, which are necessary in every branch of art for the appreciation of the value of art-works.

In consequence of this pedagogic reform, the taste for elegance and the knowledge of æsthetics would be spread broadcast. Without realizing the dream of a nation entirely formed of artist citizens, we would generalize the artistic notions in such fashion that the artists would no longer form as they do to-day a close corporation. The essential, the indispensable thing is to render the teaching of art accessible to every one. These are theories which ought to be subscribed by those who are convinced that, in a democracy, be it understood, the cultivation of the ideal must be open to every one.

H. Mereu.

ACOUSTICS.



• Palazzo Tolomei • Siena •

THE following paper was read before the Association of Architects of Western Pennsylvania by Thomas Boyd, Architect, November 25, 1887.

Acoustics is the branch of natural philosophy which governs sound. It is divided into several parts, but it is the physical part of the subject which I wish to call your attention to, and especially in its effect on buildings.

This is a subject which we should all be interested in, as we have to deal with it more or less, and what I may say on this subject I hope will be an incentive to others to cause them to experiment and try to find out some of the hidden secrets which govern sound.

Sound. What is it? The answer I will leave for you as I have not seen any definition which is satisfactory to me. Tyndal says: "Sound is a jarring of the air and is a peculiar sensation caused in the organs of hearing by the vibratory motion of bodies when this motion is transmitted to the ear through an elastic medium." Thus, air, like other bodies, is simply a medium to conduct sound. There are also many solid bodies, such as steel, wood and silver which are good conductors of sound. But what sound is, I do not think any mortal man can tell us; suffice to say that we can control sound as we can control electricity, yet we cannot analyze it. We can easily satisfy ourselves that in every instance sound is caused by a vibratory motion caused by a blow or other means, thus throwing into a state of agitation or tremor the body which emits the sound. Even large and solid bodies are caused to vibrate when they produce sound, and the more solid the body, the clearer and sharper the sound will be.

Most authors, in writing on this subject, state that a solid rock or wall will reflect sound in the same manner as though a rubber-ball were thrown against it. This I have found by experiment to be incorrect. The wall, when struck by the sound-wave, vibrates and produces a new sound, thus intensifying the original sound, which was clearly proved to my mind by the experiments of Mr. A. C. Ingert in 1880, and which I have since carefully tested.

Soft or elastic walls absorb sound, leaving nothing but the original sound to reach the ear.

Almost all bodies, soft or hard, will conduct sound with more or less velocity. As air is the general conductor of sound which reaches the

ear, it is the body which we guage other substances by. There are other bodies which are agents and are capable of transmitting sound more clearly than air, water being a seven times better conductor.

Also, the intensity of sound is much augmented if its vibrations are confined in a tube or cavern of some kind, for instance, the speaking-tube, which we all so well know the value of. Thus, the cavity of the human mouth as well as the important parts of most musical instruments is a resonator, which not only improves the sounds, but to which their quality, value and character are chiefly due. Sound not only differs in character, but also in intensity, although seeming to be produced by inferior bodies; for instance, the cicada or harvest-fly, which is remarkable for the loudness of sound it emits; the organs that produce this sound consist of membranes and fibres connected with powerful muscles and situated on the under side of the abdomen, and the sound which they emit resembles the grinding of a knife on a whet-stone, and can be heard for a half mile or more.

Again, reflectors, sounding-boards and walls in close proximity to the singer or speaker augment and intensify the effect, as a mirror augments a light, and the resonance and sympathetic vibration of solid bodies is due to the reinforcement and enrichment of sound produced by instrumental sounding-boards, such as those of a pianoforte, or those of other stringed instruments, such as the violin or guitar, and of which no more striking illustration can be given than the familiar one of placing the stem of a vibrating tuning-fork against a resonating body, such as a table or a hollow wooden box.

The defects in large audience-rooms and even in small rooms are brought about by one or more of the following seeming acoustic phenomena and sometimes by all of them.

First, Dispersion. — This is where we have large and lofty buildings, such as Gothic cathedrals; the human voice is not powerful enough to fill the entire space, and the sound is left free to take the currents of air and especially the moisture, and is lost among the arches and transepts, leaving but a small portion to reach the ear of the audience.

Second, Resonance. — This is caused by the solidity of the walls, sending back different notes, coming almost simultaneously with the first note sounded, and continuing some time after, which is noticed by a ringing sound the same as the striking of a bell. This defect is very noticeable in small rooms and makes it very difficult to hear and speak in them, and the least noise is very irritating to a person who is of a nervous temperament. We notice this defect very plainly in the Allegheny Council-Chamber and especially in the Select Chamber.

Third, Echo. — This is a defect in very large rooms and is produced from the same cause as resonance — throwing back the sound from the walls. It is only noticeable in very large rooms.

We have also the acoustic defects of interference and sympathetic vibration, but these do not often interfere with the acoustics of a room.

The first defect, Dispersion, can easily be managed by means of ventilation. As I stated before, air is but a conductor of sound, and water is at least a seven times better conductor; using this knowledge, all that is necessary is to force moist air in at the apex of the ceiling and carry it to within ten or twelve feet of the floor and then take it off on all sides of the room. In this manner, we produce the same phenomenon that we observe in the open air before rain or when the dew is falling; we can then hear a sheep-bell for a half mile or more. We also notice this phenomenon in the Capitol building at Washington in two places, which are called the whispering-galleries, one at the top of the dome and the other in what was the old Representatives' room. In the latter, we find that the air is forced through the long corridors, and, as it enters this room, it is carried up against the arches, and this being cold marble, condenses the moisture in the air, forming a swirl of vapor which is held in the angle where the arch joins the ceiling, and this forms a regular speaking-tube. Persons standing in opposite corners can converse in an ordinary tone, while those standing between cannot hear even a sound. We also find the same result in the dome, produced by a similar cause.

We have many illustrations of the fact that water is a much better conductor of sound than air, such as striking two stones together under the water, or take a music-box and seal it tightly and place it under an air-receiver; by insulating the box, we find that the sound travels through the air, when if we exhaust the air the sound ceases in proportion as the air is exhausted; then if we fill the receiver with water, we find that the sound is very much increased.

Second. — Resonance is produced by a reproduction of sound in the same manner as we hear the sound in the receiver of a telephone; we know that the sound does not travel for miles on the wire, but yet we are able to hear and recognize the voices of those we know. If we take the receiver apart, we find only a magnet and a very thin diaphragm of steel and iron. As the current of electricity is sent along the wire (which is the conductor) the diaphragm of the receiver, that we hold to our ears, vibrates and produces the very sound and tone of the transmitter spoken against. We find the same phenomenon in a room; the sounds are reproduced by the walls and ceilings and are carried back through the air to our ears. All that is necessary is to form the walls and ceilings so that they will not reproduce, and this is a simple matter, as there are a great many materials that can be used for this purpose. All that is required is to form the walls with a soft or resilient surface, except those in close proximity to the speaker, which should be made hard and solid.

In regard to echo, we know that sound travels 1125 feet per second, and it follows that if a man were articulating five syllables per second, it would require a sounding-board to be placed 112½ feet distant so as to make a distinct echo. This is a serious defect in large rooms, as the clashing of sounds is very destructive to the ability of the speaker, and it is more serious to singers, as notes are introduced at the wrong time, giving rise to false combinations and discord, producing what is called wooliness of outline. This defect is caused by making hard and solid walls at the opposite ends of the room from the speaker, which should be avoided in all cases. If a hard and solid surface is formed in close proximity to the speaker, it will intensify the sound and improve the acoustics. I have built several audience-rooms in which this was clearly demonstrated and can testify from actual experience.

In regard to interference: this is where two sounds are produced in such a position that they meet on the same crest of the air-wave. This has caused Tyndal and others to make the statement that sound is the jarring of the air. For example, take two tuning-forks and hold them in certain positions and the sound of one will destroy the sound of the other, but move them slightly and you can hear the sound of both distinctly; the latter is the case when the sounds pass each other, as they meet crest to trough in the same manner as in the Duplex telegraph system, where two or more messages pass each other on the same wire.

Sympathetic vibration is caused by placing two stringed instruments in the same room, and by playing on one the strings of the other will take up the chords and reproduce them; but it is not necessary to place the instruments in the same room. We may take a piano and insulate the feet, and if we mortise a hole through the ceiling into the room above and then fit a strip of wood through this hole, running the same above the floor, and then letting it rest on top of the piano, and placing a stringed instrument on top of the stick, we can hear the tones that are produced below, and a person sitting near it, can hear the music coming from it as though some ethereal hands were playing upon it with the lightest possible touch. This very interesting experiment goes to show that either air or wood will conduct sound, and the strings are thrown into a tremor by the instrument played upon below. This is the case with all sonorous bodies, and it must be familiar to many persons that even a common hat held in the hand in the presence of loud music is thrown into a state of vibration when certain notes are produced, which vibration is distinctly sensible and causes a tremor to the hand holding it, and I may here say that anything which is capable of being thrown into vibration with sufficient rapidity to constitute a sound, may be thrown into sympathetic vibration by corresponding sounds produced with sufficient force in the neighborhood.

I think that we can safely say that all the above seeming phenomena, with the exception, perhaps, of the first, *i. e.*, dispersion, are, with respect to their acoustic influence upon a building, either decidedly useful, harmless or positively detrimental, according to the distance of the disturbing body from the source of sound, be it small or great.

In conclusion I would state that if the walls and ceilings are properly constructed in any ordinary-sized audience-room, the acoustics will be good and the rooms can be so constructed that sounds made in certain parts of the room can be heard more distinctly than if made in other parts of the room.

With regard to the size and shape of the audience-room I would say that this has but little effect on the acoustics if the walls, floor and ceiling are properly constructed and the ventilation is carefully arranged.

The Water-Capacity of Soils.—Herr E. Wollny has been making a long series of very exhaustive experiments, which have led him to form the following conclusions: 1. The water-capacity (measured by volumes) of a soil diminishes with a rise in temperature. The opposite is the case with peat. This diminution is relatively greater the larger the pores in the soil. 2. (*a*) The freezing of the water in soils usually causes a diminution in their water-capacity. (*b*) This latter result is merely transient in the case of soils of only a slight cohesive character — *i. e.*, coarsely granular, sandy, poor in vegetable matter. It is of a more permanent nature in the case of soils which show a tendency to form crumbs — *e. g.*, finely granular, argillaceous soils, or soils rich in vegetable matter. (*c*) The result mentioned in (*a*) is more marked the greater the quantity of water in the soil, and the more frequently (within certain limits) the frosts alternate with thaws. (*d*) In the case of crumby soils, the duration of the diminished water-holding capacity may be materially altered and even converted into an increased capacity if there are frequent alternations of frost and thaw or the crumbs are loosely aggregated, as this facilitates the breaking up of the crumbs into a finer state. An explanation of these facts is the increased or diminished aggregation of the soil, resulting from the freezing of the water in the soil. 3. (*a*) The water-holding capacity of a coarsely-granular soil is increased by the presence of even a very thin (3–5 cm.) difficultly permeable subsoil — *e. g.*, clay. The more so the nearer the latter is to the surface. The effect is more marked the greater the difference of water-capacity of the upper and lower soils. (*b*) An easily-permeated subsoil only slightly increases the water-capacity of the soil above it if the latter is of a finely-granular or argillaceous character, but diminishes its capacity if it is more coarsely granular. — *Jour. Soc. Chem. Industry.*

INTERNATIONAL RAILWAY CONGRESS AT MILAN.



LITTLE CASTERTON, RUTLAND.
AFTER "THE BUILDING NEWS".

A PERMANENT and international railway commission, composed of the representatives of the various governments, railway administrations, and railway companies was formed two years ago through the initiative of the leading officials of the Belgian State Railway for the purpose of taking into consideration questions, technical, economical, and humanitarian, affecting railway working. The first Congress was held at Brussels in 1885, and the second has lately been held at Milan under the presidence of Commendatore Professore Francesco Brioschi, senator of the Italian Kingdom, and director of the Milan Technical Institute. Though the Congress was held in Italy, the discussions were carried on in French, which is still the universal language in Europe; but the various accents and intonations of Belgians, Russians, Italians and others made it very difficult to follow the proceedings. The States were represented by Mr. Ely, engineer-in-chief of the Pennsylvania Railroad, who, with Mrs. Ely, were honored guests at a dinner given by Sir Andrew Fairbairn, director of the Great Northern Railway, to British members of the Congress.

Among the subjects discussed, metal sleepers were generally approved of; mild steel was recommended for bridges with special attention to its selection, especially for large spans; the practice of letting the maintenance of permanent way by contract was condemned; snow was considered too variable a quantity in different countries for any general rule to be laid down as to its removal; good ballast, frequently renewed, with larger sleepers and stronger fish-plates than hitherto used, were recommended, together with constant and minute inspection; and it was considered preferable that a set of engines be entrusted to a gang of drivers, instead of each driver having his own engine. With respect to the construction of passenger cars, M. Banderali, of the French Northern Railway, brought up the report of Section II., recommending that wheels be perfectly balanced, and that, whether there be a double set of springs or not, some elastic substance be interposed between the body and under-frame. What could be done, he urged, in the way of deadening the effect of shocks due to the irregularities of the road was proved by the careful manner in which President Garfield, when lying sick and wounded, was conveyed a long distance to the sea-shore. The Section considered that dead weights per passenger carried, should be reduced to a minimum, additional room being charged extra, all which was endorsed by the Congress.

While steel proper was condemned for locomotive boilers, homogeneous metal was approved of, and a jet of steam or water, instead of sand, for securing the adhesion of the wheels; a mixture of vegetable and mineral oil was recommended for lubricating axles, and white-metal for the bearings; fixed and sufficiently remunerative wages should be paid to drivers, with premiums for economy so long as they do not interfere with safety and efficiency; improved connections for continuous brakes were demanded; but the latter were impossible for goods-trains so long as there was such diversity of rolling-stock; the problem of electrically lighting trains had not yet been solved, and, hitherto, enriched gas had given the best results; there was still much to be done in the warming of cars, but, at present, moveable foot-warmers were to be preferred.

Tickets or coupons should be checked and taken on the run instead of at stations; simplification in the construction and working of lines with slight traffic was enjoined; for lighting stations electricity was greatly preferred to gas; railway servants should be chosen as much as possible from the families of those so employed; and women, though physically weaker, were far more to be relied upon than men for railway work; higher wages should be paid to the lower grades of railway servants, and mechanical means used as far as possible for lightening their labor; while the general feeling was against any government tax being imposed on the transport of goods.

With respect to questions specially affecting secondary lines, it was agreed that these should be made and worked as simply as possible; continuous brakes were deemed unnecessary, as was a baggage-van between the engine and first carriages; a 10-ton car with longitudinal passage was recommended, and the abolition of a guardian at level crossings; while any attempt at unification, whereby light lines would be made into a system, was to be deprecated, as that would be construed by the railway companies as an attempt at competition, and resented accordingly.

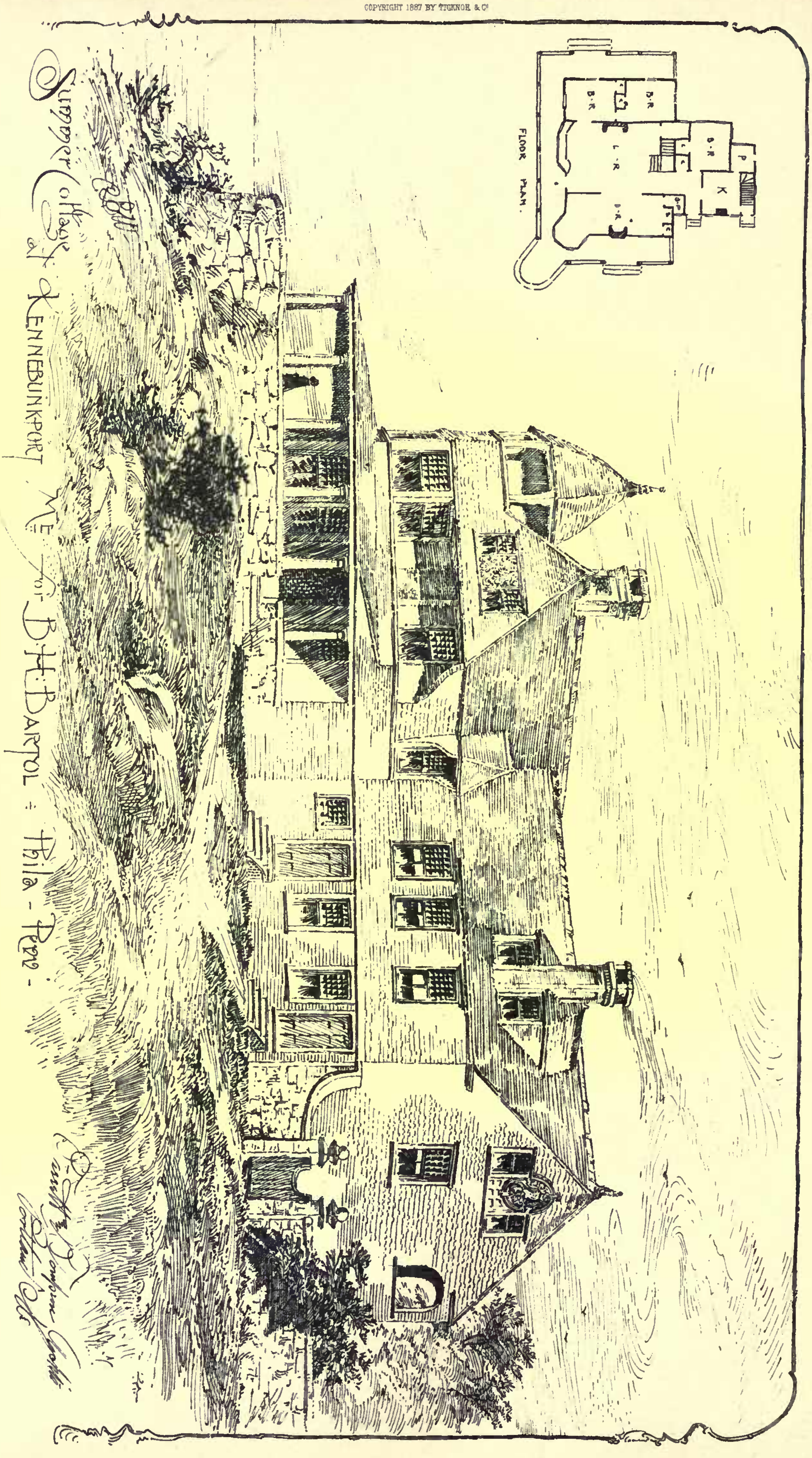
During the Congress, the members inspected an hydraulic arrangement at Abbiategrasso, between Milan and Mortara, for working points and signals, whereby a woman can easily perform the work, or even the station-master from his office. A few hours' pumping by one man daily is sufficient to charge the accumulator, and the addition of ten per cent of glycerine to the water prevents it from freezing. This arrangement, the invention of Ingegnere Bianchi, Chief of Section for Permanent Way on the Italian Mediterranean Railway System, has passed the government inspection, is being applied to the Savona Station with sixty-five levers, and will be used henceforth at all new stations. The members also witnessed the decomposition and reforming of goods-trains at the *smestamento* (sorting) station of Porta Sempione, Milan. The trains, as they arrive, are run onto a gradient of one in one hundred, where each wagon is marked with a large figure in chalk representing the siding where the new train is to be made up. The wagons are then detached, and run down by gravity, a man giving a bugle signal, as each wagon passes, to the pointsman, to inform him what siding to turn it onto. At this station, also, is a weigh-bridge, designed by Signor Bianco, Chief of Division for Permanent Way on the Mediterranean System, the platform of which, clear of the rails, is never taken off the knife edges. When it is desired to weigh a wagon, two angle bars are brought by a system of rods and levers against the rails, and receive the flanges of the wagons.

The two leading principal railway companies of Italy, the Mediterranean and the Adriatic, which divide between them longitudinally, and in about equal shares, the working of nearly all the lines in the peninsula, have recently adopted the mechanical system of statistics devised by Cav. Bonazzi, which was specially brought before the members of the Congress, many of whom made themselves acquainted with its working. This system, which saves half the number of clerks, gives very complete information, brought up to date, about the working of a railway and the traffic. The main principle consists in taking tickets from a perforated roll of paper-tape in a receptacle, and sticking them onto another roll, wound up in a receiver, the various categories of rolling-stock being represented by certain colors, and the units, tens, hundreds, and thousands of kilometres or miles run by other colors. The system, however, is capable of constant perfection and application to individual requirements, and may be used with advantage for recording time worked at factories, births and deaths for municipalities, imports and exports, patients at hospitals, soldiers in an army, prisoners in jail, and, indeed, an endless variety of purposes.

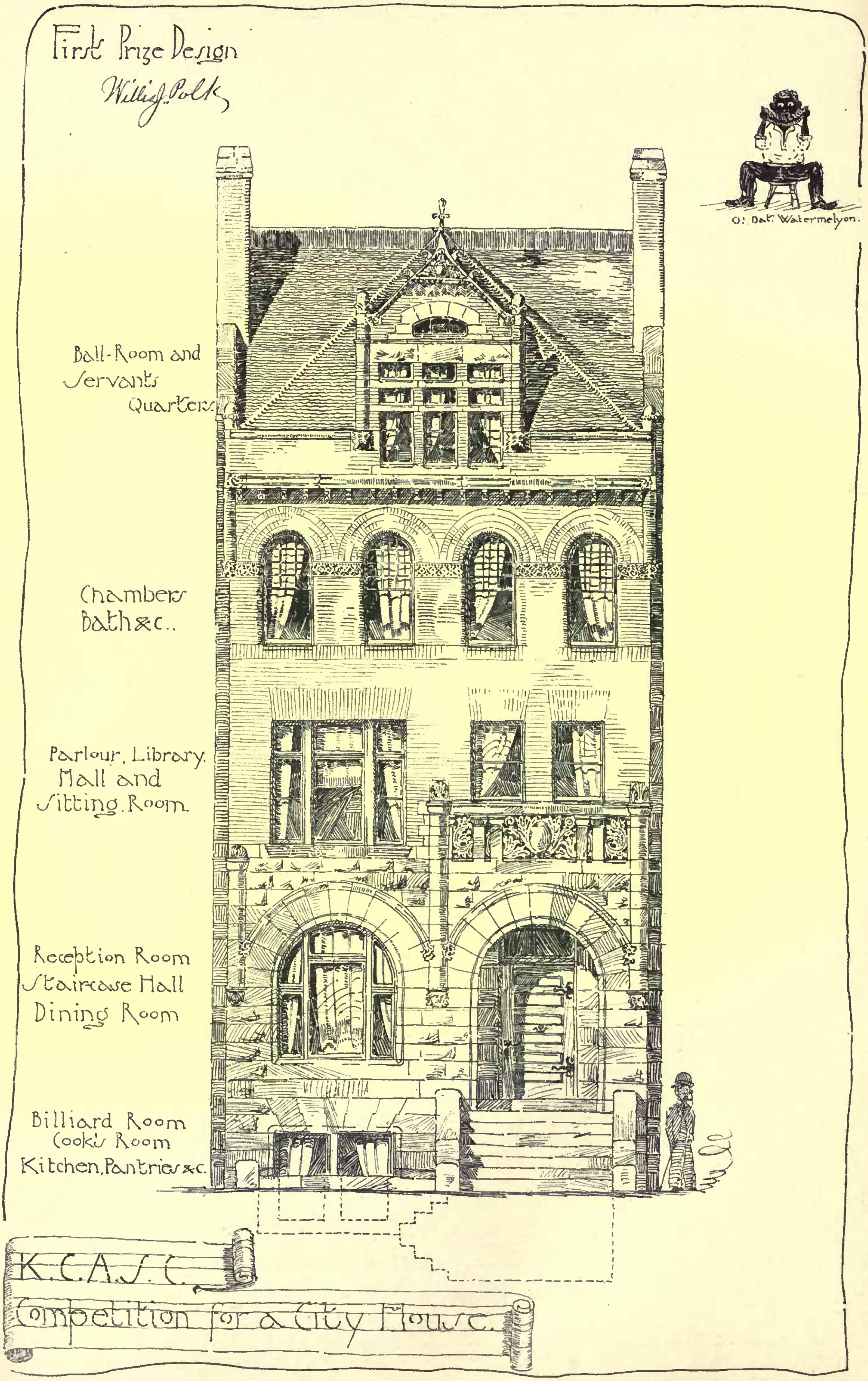
The general meetings were held in the handsome *foyer* of the Scala, which disputes with two or three other theatres the honor of being the largest in Europe. The fact is that one is largest in one respect, and another in another. The Scala holds from 3,000 to 3,500 persons, and has so many exits that it can be cleared in eight minutes. The acoustic properties are something marvellous for so vast an interior, which has five tiers of boxes. The theatre, designed by the Architect Piermarini, was built between 1776 and 1778; and the stage was reconstructed and enlarged by Canonica in 1814; its dimensions are: depth, 37 metres = 121 feet, width 25 metres = 82 feet, and height to roof, 27.3 metres = 90 feet. The pit is 24.84 metres = 82 feet long, and 22 metres = 72 feet wide. There is ample provision for arresting any fire that may break out. The theatre is illuminated by 2,860 incandescent electric-lamps, 150 candles being also lighted every night, to provide for the possible failure of the electric plant. All the rest, except one of the Milan theatres are now lighted electrically, as under: Dal Verme, 1,650 lamps; Manzoni, 500; Filodrammatici, 350; Fossati, 300; Milanese, 120; Fiando (for children), 50. The incandescent lamps for lighting the theatres, hotels, cafés, and many of the shops, together with the arc-lights on the Thompson-Houston systems in the main thoroughfares, are maintained from a central station in the Via Santa Radegonda, at a cost rather exceeding that of gas, but with far greater efficiency.

To merely mention the city of Milan without a word about its beautiful cathedral, would be something like the play of Hamlet with the part of Hamlet left out. For a long time its foundation was ascribed to Giovanni Galeazzo Visconti in 1386; but later investigations have shown that this, the most elaborate and magnificent Gothic edifice in existence, was due entirely to the initiative of the Milanese people, and erected at their expense. It was built on the site of a chapel to Santa Maria Maggiore, which became a ruin in 1162, owing to the fall of its *campanile*, then held to be the highest in Lombardy, destroyed by order of Barbarossa. Whether the cathedral be due to Duke Visconti or the Milanese people, certain it is that the former bequeathed a quarry at Candoglia, Lago Maggiore, for exclusive use on the building, and that all the repairs, restorations, and additions are executed with this stone. This is a very compact and solid marble, not purely white, but tinged with red and yellow in places, and having blue veins in others, though the new work, and also that which has weathered, especially with the sun shining upon it, appears quite white. The low-pitched roof is covered with large and thick slabs of the same stone, the edges of the upper side and two ends having a low but wide fillet where the joints occur, which are made good by a seam of asphalte.

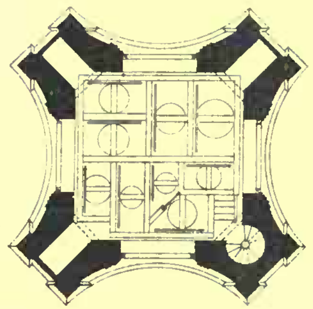
Whether the cathedral be due to the munificence of one individual or to the united piety of a whole people, their descendents have not shown themselves worthy of so beautiful and unique an edifice,



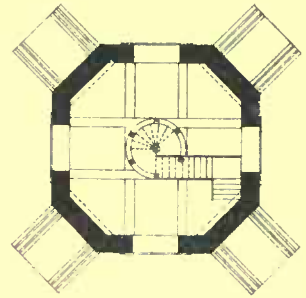
Heliotype Printing Co. Boston.



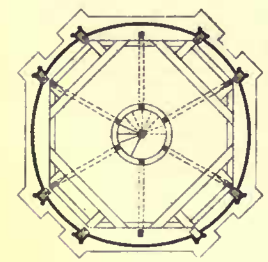
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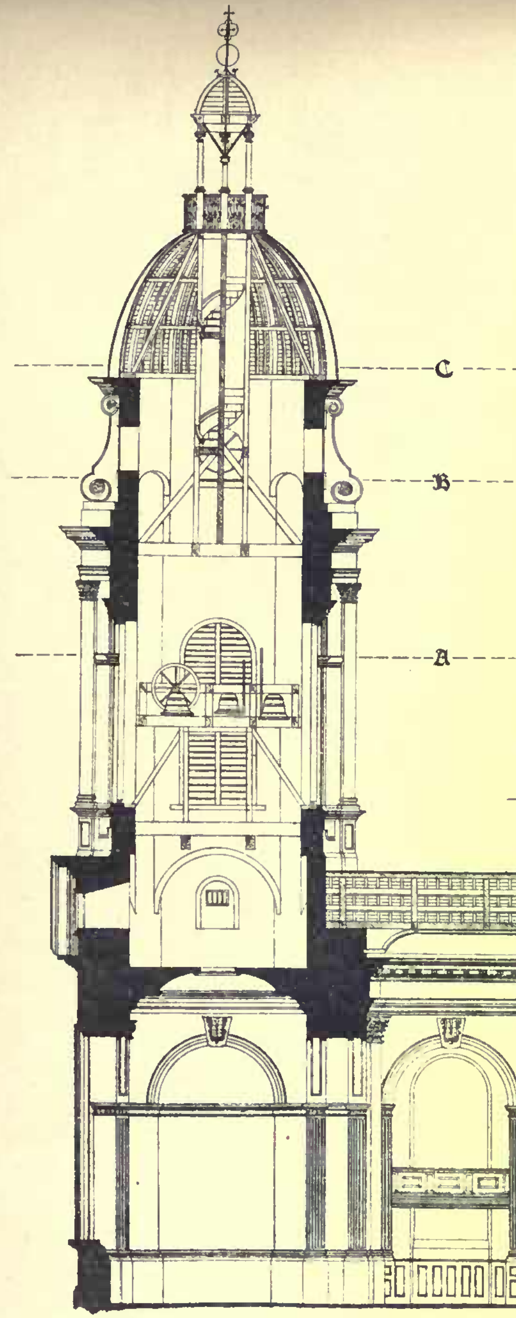
Plan at Stage-A

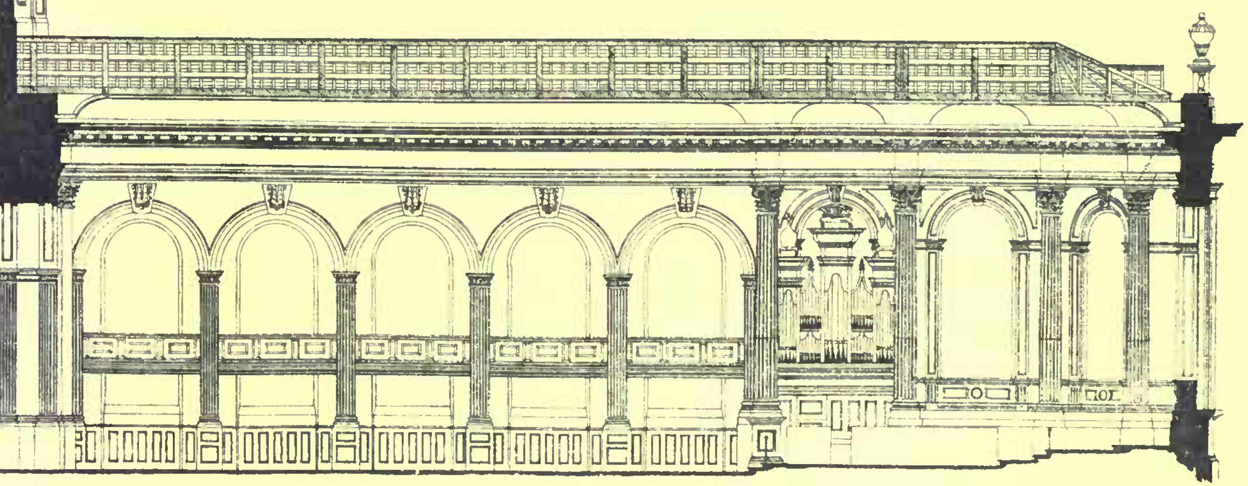


Plan at Stage-B

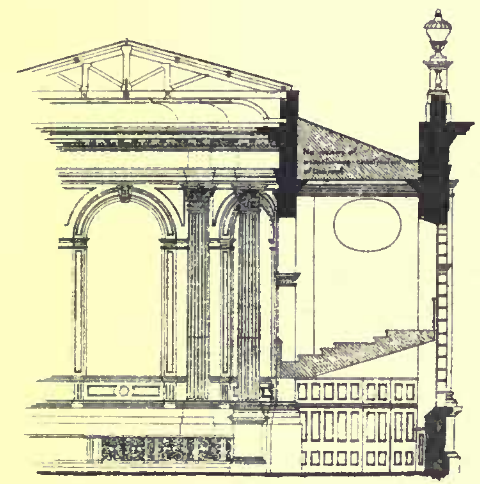


Plan at Stage-C





Longitudinal : Section



Transverse : Section

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American Architect and Building News, Dec. 17 1887.

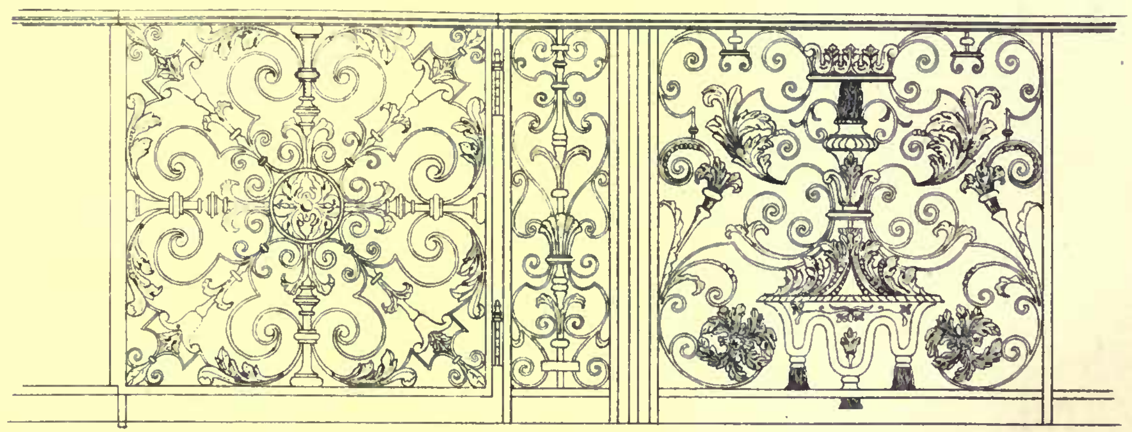
St. Phillip's Church, Birmingham.

Erected A.D. 1710. Thos. Archer, Architect. [a pupil of Sir Christopher Wren]

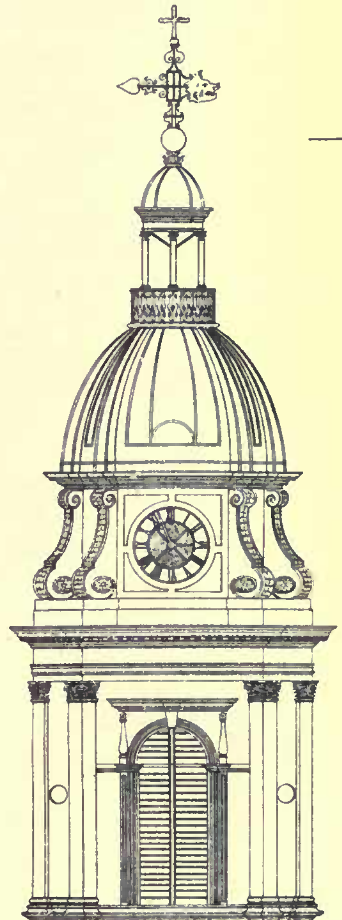
Measured by Norman St. Clair and William. C. Midgley. 1884. Drawn by Norman St. Clair.

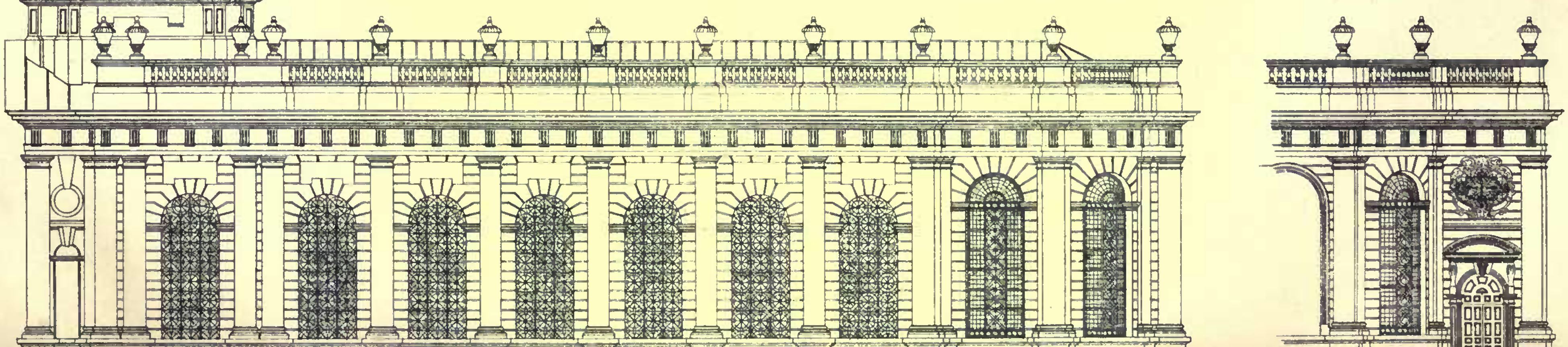
Scale for Elevations

Scale for Detail



Elevation of Chancel : Rail

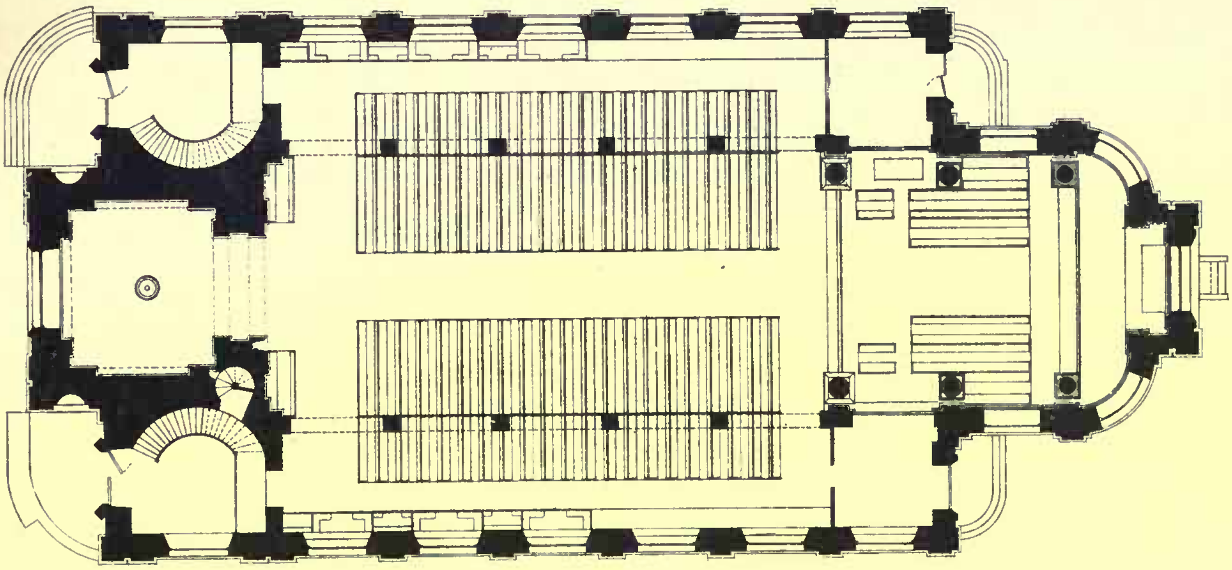




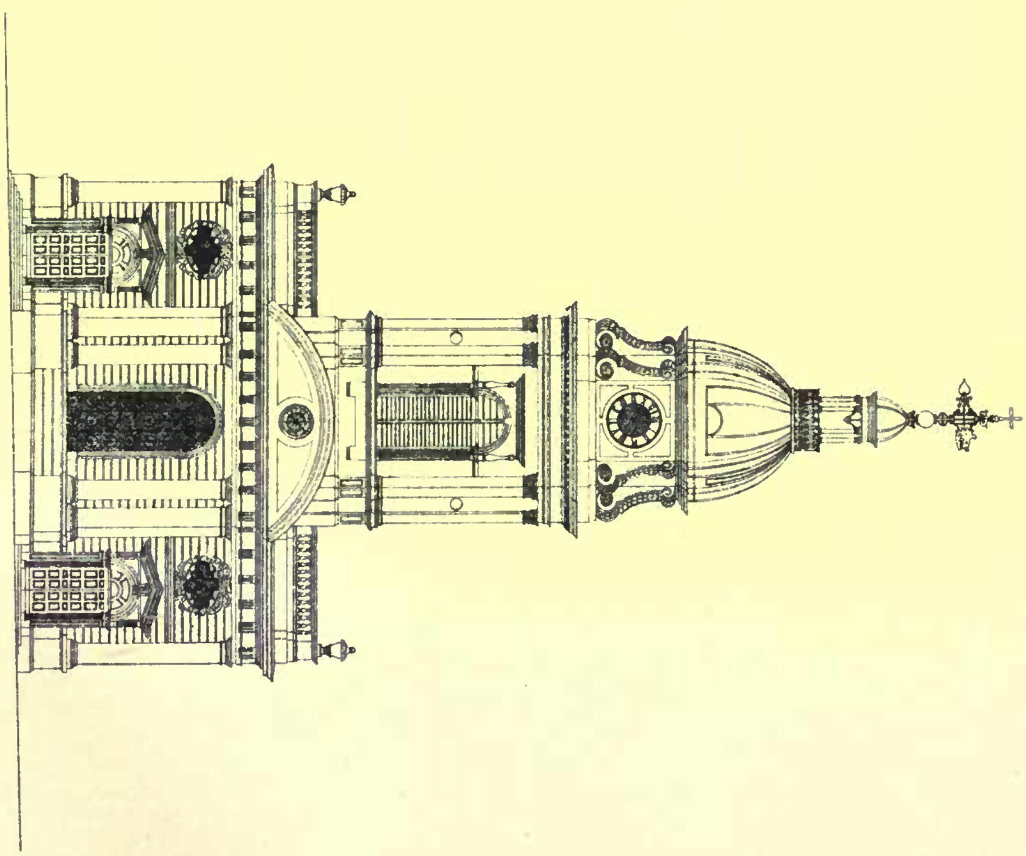


HOUSE · OF : DR · MORTON :
· 35 · WEST · 56th · STREET : NEW · YORK :
· BRUCE · PRICE · ARCHITECT · · · ·

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Plan



St. Phillip's Church, Birmingham.

West Elevation

Measured Drawings.

Heliotype Printing Co. Boston

for they have done their best to dwarf its fair proportions. The Galeria Vittorio Emmanuele, itself a handsome structure in the Italian style, and the arcade facing it, the two flanking the Piazza del Duomo, which extends before the west front, should have been erected anywhere but in their present position, for when they form the foreground of any view including the cathedral, they simply make it look small; and it is only by remembering that each of the one hundred and twenty-two statues which terminate the pinnacles are larger than life-size, that one has a just idea of the grandeur as well as the beauty of the structure. The west front was begun in the Italian style, and continued in a later Gothic than the rest of the edifice, and the Milanese are not satisfied with it, so they have a project for reconstructing it; but it is doubtful if anything done to the cathedral can take off from the unfortunate effect of its too modern and too imposing surroundings. A far more pleasing view of the building than that obtained by looking towards the west front is that of the intersection of nave and transept seen from the Corso Vittorio Emmanuele, with a foreground of comparatively old and irregular houses in shade, and the early morning sun lighting up the statues and the ornate buttresses, which glisten as if they were made of the purest Carrara marble.

The streets of Milan are paved on one uniform model which has been found to answer very well hitherto; but now that the surface is constantly being disturbed for laying tram-rails, gas-pipes, and electric wires, trials have been made of other systems, without, however, finding anything better. Narrow streets, which are the rule in Milan, have two lines of granite flags laid on a double course of brickwork, forming a tramway for ordinary vehicles, the space between the flags being pitched with small pebbles and made slightly concave to receive the rain-water which runs off through stone gratings into the oviform sewer below. The footways are paved with granite flags, slightly inclined to let the water run off, but not raised above the surface of the roadway, and the space between the footway and the granite tramway is pitched in the same manner as that between the granite flags of the tramway. In wide streets, there are two lines of granite tramways, the space between them being convex and pitched with pebbles.

For demolitions and constructions, hoarding is carried up the total height of the building, but is only boarded as high as the ground floor, the remainder consisting of reeds or coarse sacking attached to a light framework. For cleaning and decorating the fronts of houses, openwork wooden towers, travelling on four rollers, are used, some of which have a provision for increasing or diminishing the height at pleasure. Aerial ladders are also much employed in all the public services. The *scala* Porta, which seems to be most in request, consists of a wagon carrying a series of ladders diminishing in breadth and in the thickness of the sides. The top ends of one carries sockets for receiving the lower ends of the next, and so on, a rung driven in at the joint making all tight. Short iron struts are also attached to the joints, and four rods for each ladder, two acting as hand-rails and the others as diagonal ties, solidify the aerial structure, which, when raised by a winch and double bell-crank and balanced by counterweights on sliding bars, is capable of supporting as many men as can get upon it. The greatest height yet made is 35 metres or 115 feet, and this size can be conveyed by four horses and put together by four men in five minutes.

Milan is built on the left bank of the little river Olona, which is connected by a system of canals with the Adriatic and also with Lakes Como and Maggiore, 80 metres or 262 feet above the level of the city. The difference of level is surmounted by a series of locks, which, it is said, were invented by Leonardo da Vinci, who, like Rubens, was architect and engineer as well as artist, and who has left in his city of adoption specimens of his skill in all three branches. His statue, as embellisher of the city, by P. Magni, adorns the Piazza della Scala. Though Milan, however, has not the advantage of being on a large river, it has become the commercial capital of Italy, and now numbers 350,000 inhabitants. The city has more than once extended its boundaries, and the time has now arrived for still further extension. A special department of the municipality has been appointed to carry this out systematically, with the making of new thoroughfares in the old city, special attention being bestowed on that quarter which contains the Castello, which dates from the fourteenth century, the imposing Arco della Pace, and the Arena, modelled on the Roman Amphitheatre. The figures on the frieze of the interior of the monumental entrance-gate are so skilfully painted as to appear in *alto relievo*, and it is only when the visitor looks at a part on which the light falls directly that he can be persuaded of the illusion. The future city boundary is to be a circle, obtained by a give-and-take arrangement of area with the adjoining communes or townships.

The notables of the Congress dined one night at the Monza Palace of King Humbert, who is so liberal a monarch in the van of all progress, moral and material, that he is more like the president of a republic than a crowned sovereign. Monza, the ancient Roman colony of Modicia, is now the Versailles of Lombardy, and, with easy access to Milan by railway and steam tramway, is an agreeable residential town, with numerous villas beautifully situated. The Royal Palace was erected in 1777, from designs by Piermarini, and includes a vast hall adorned by many paintings of merit. The members were officially received and very hospitably treated by the Prefect of the Province of Milan and also by the Syndic or Mayor of the city, at the Palazzo Municipale, designed by Galeazzo Alessi in the Michael-Angelesque style, and having a court-yard ornamented with considerable elegance and richness. During the Congress the members paid a visit to the Palazzo Litta, once the town-house of a noble Italian family, and now serving for the general offices of the Italian Mediterranean Railway Company. Though the movable works of art have been removed, the elaborate marble staircase still remains, a relic of former grandeur. Here is the Statistical Bureau, where the Bonazzi mechanical system, above mentioned, is worked, so that the officials can at any time feel the pulse, as it were, of the traffic.

But the *dulce* which relieved the *utile* of the Congress was not confined to the hospitable city of Milan. A special train took the members to Venice, where they had an opportunity — too short, alas! — of viewing the treasures of the Fine Art Exhibition. Another day they went to Genoa, la Superba, passing on the way the famous Certosa or Carthusian Monastery at Pavia, dating from the fourteenth century. At Genoa, they were entertained at luncheon in the Palazzo Ducale, the large hall of which is grandiose and magnificently decorated. Then, with no time to view the many objects of interest in the city of Christopher Columbus, they embarked on board the "*Umberto Primo*," a fine steamer of 1,400 tons burden, which has since got on the rocks off Ischia, and were steamed along the marvellous Riviera Orientale, where the Apennines, here coming down close to the edge of the blue Mediterranean, are studded with white villas. Eyes were strained to descry the column put up to commemorate the embarkment of Garibaldi with "the thousand" (*i mille*) for Sicily in 1859. In the evening, the members were entertained by the Syndic of Genoa at the Municipalità, where are preserved Paganini's violin and bow. The "bouquet" of the excursion was, however, reserved for the close of the Congress, in the trip to Lake Como, which was visited with the most agreeable accompaniments. The party embarked on a steamer at Lecco, lunched or rather banquetted at Bellagio, the large *salle* of the hotel which accommodated one-third of the party, being decorated in the Pompeian style, and finally landed at Como, where the whole population seemed to have turned out to greet them, and if the members did not learn the tune of the popular and spirited "Marchia Reale," it will not be through want of hearing it sufficiently repeated.

J. W. P.

THE ILLUSTRATIONS

[*Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.*]

THE PARLIAMENT BUILDING, OTTAWA, CANADA. MESSRS. THOMAS FULLER AND CHILION JONES, ARCHITECTS.

[Gelatine Print, issued only with the Imperial Edition.]

SOME mention of this building was made in the *American Architect* for October 15.

KANSAS CITY ARCHITECTURAL SKETCH CLUB COMPETITION — A CITY FRONT BY MR. W. J. POLK.

SUBJOINED is the report of the judge: —

In judging these designs, which are so varied in character and merit, it occurred to me that the most satisfactory method of forming an opinion would be by a careful analysis of the various components of a design, and by making a judgment on the comparative points of each component; accordingly, I arranged a system by which I was able to grade the various drawings as to their merits.

1. In construction, meaning by this the obvious facility with which the design could be executed, and its fitness when so executed, keeping in mind particularly the arrangement of the piers and windows for proper distribution of loads. 2. Proportion of parts forming the composition. 3. Detail. 4. Rendering.

Nine drawings were submitted, and in each class I established a grade from one to nine, nine being the highest number of points in any class, there being four classes. Having established this system, I proceeded carefully to credit each drawing with the number of points in each class which it seemed to merit. Before making a computation of the totals, I laid aside the calculations and proceeded to form an abstract judgment without the aid of this system. Having reached a conclusion in this particular I proceeded to cast up the totals of points, when I found that in each particular the judgment by points corroborated the abstract judgment.

The following is the score:

	Construction.	Proportion.	Detail.	Rendering.	Total.
"*O' Dat Watermelyon.*"	8	9	9	9	35

From this showing you will see that the design, "Oh Dat Watermelyon," has received the highest number of points, and is, in my judgment, the most meritorious design submitted.

In closing I would say that I am much pleased and surprised at the general excellence of the designs submitted.

(Signed) FRANK M. HOWE.

HOUSE FOR DR. MORTON, NEW YORK, N. Y. MR. BRUCE PRICE, ARCHITECT, NEW YORK, N. Y.

ST. PHILIP'S CHURCH, BIRMINGHAM, ENGLAND. FROM MEASURED DRAWINGS BY MR. NORMAN ST. CLAIR.

COTTAGE FOR B. H. BARTOL, ESQ., KENNEBUNKPORT, ME. MESSRS. FASSERT & THOMPSON, ARCHITECTS, PORTLAND, ME.

THE MEDIÆVAL GRILLE.[1] — II.

(From the French of Viollet-le-Duc.)

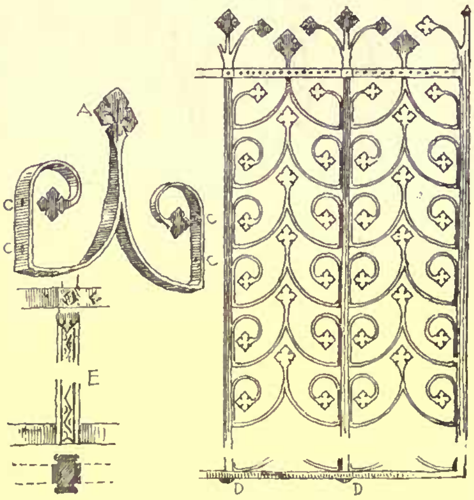


Fig. 11. Fourteenth-Century Grille.

We have seen a fragment of a fourteenth-century grille (Fig. 11) which may be said to mark the transition from stamped iron to riveted sheet-iron ornaments. Stamping was already abandoned, while the principle of upright and cross-bar construction still obtained. The ends of the scroll-irons were hammered into a lump, flattened by the hammer and then fashioned into the cut leaves. Instead of being fastened to the uprights by means of shoulders as in the thirteenth-century grilles, the scrolls were riveted laterally. The vertical bars were passed through eyes in the upper cross-bar, and riveted to the lower one. They were then covered with two thin plates of beaten iron, retouched and engraved with the burin.

This grille — from a railing, Magasins de St. Denis — was nearly a metre in height, the uprights and traverses measured 0.016m. in the broad side by 0.025m. on the edge, and the foliation 0.006m. by 0.016m. on the flat.

At the end of the fourteenth and beginning of the fifteenth century, the hammered plates were welded to the heavy irons, and it was not until later that the ornamentations was riveted on. In the cloister of the Cathedral of Puy-en-Vélay is a very cleverly forged grille, (Fig. 12) each rail of which carries an accolade welded to the uprights, the upper end of the accolade being riveted to the middle upright of the panel; the trefoils are flattened in forging, and the flower-pieces of thin iron welded to the accolades. Between the uprights are small plates of thin iron in the form of arches, which are cut out and shouldered into place. The top flowers, also of thin iron, are carefully welded to the points of the bars. The bases and capitals of the uprights and the profiles of the counterforts, or frame-bars of the panel, are fashioned with the hammer and show no file-marks.

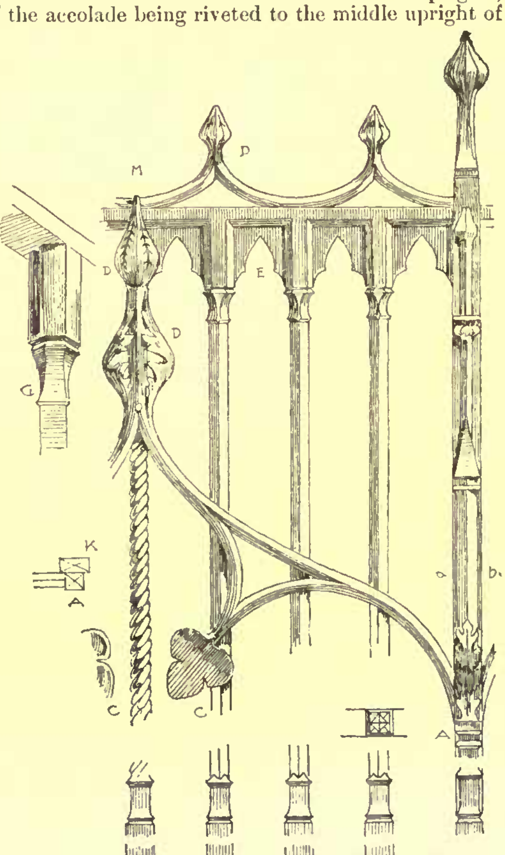


Fig. 12. From the Cathedral Cloister, Puy-en-Velay.

In the early part of the fifteenth century the uprights were sometimes set at an angle, an arrangement which permitted the fastening on, without collars or rivets, of the ornamental filling of the panels.

The Cathedral of Constance has an example of this kind (Fig. 13), in which the diagonal irons are held by grooves to the traverses set edgewise, and the flat foliations, riveted to the diagonals, are spread out into thin plates, ornamented upon the edges and of various designs.

In the cloister of the same cathedral there is a very beautiful fifteenth-century grille (Fig. 14), quite without ornament of beaten or stamped iron, the simple composition of which merits study. In this grille the counterforts support the traverses, and the uprights are passed through the traverses and set with a corner outward. Every second upright is fashioned on the upper end to receive the riveted scrolls. The alternate uprights have a tenon which is fitted into the upper cornice, passing through the scrolls.

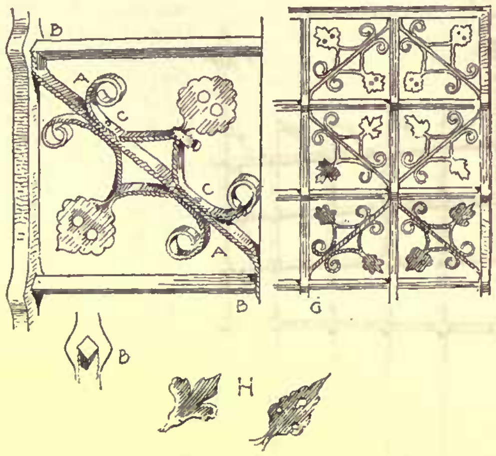


Fig. 13. From the Cathedral, Constance.

The lower ornamentation is similarly applied. The scrolls are returned up the side of the counterforts and fastened by the traverses, being riveted at the other end to chamfers fashioned on the lower ends of the lances. The uprights passing through the scrolls are fastened into the horizontal bar.

The whole is a very solid scheme of framing the scrolls, being not only riveted, but also firmly held by the tenons of the uprights.

The Mediæval grilles usually show more or less richness of workmanship in their crownings, which are ornamental prolongations of the uprights above the upper traverse. In the choir of the Cathedral of Toulouse are some fifteenth-century fan-light grilles, the crownings of which are liberally enriched (Fig. 15), in order to fill up the trilobes of a stone arch.

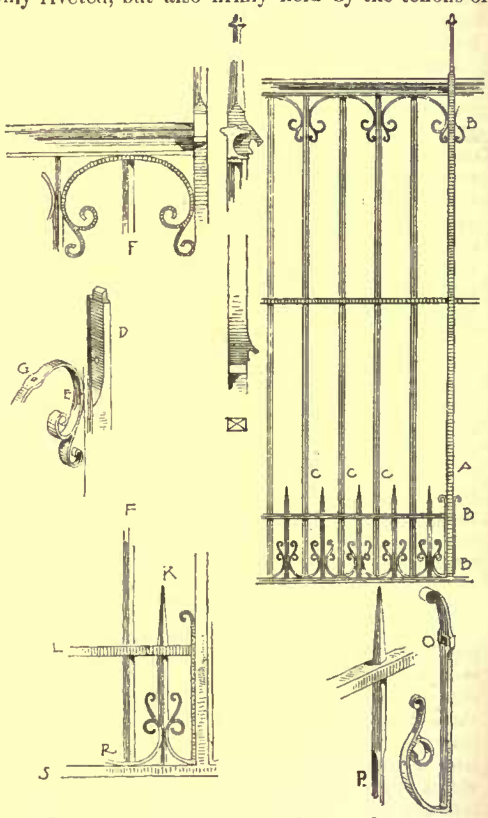


Fig. 41. From the Cathedral Cloister, Constance.

In fact, nearly all grilles belonging to Mediæval houses and châteaux display this terminal blossoming of the uprights. The window-grilles of the Château de Tarascon (Fig. 16) are arranged with uprights passed through eyes widened in the traverses with which they combine into perfect squares: the middle and two end uprights are terminated by flowers of thin flat iron welded on, the lower ends being sharpened into keen points, and both uprights and traverses otherwise have squared elbows and are fastened into the stone.

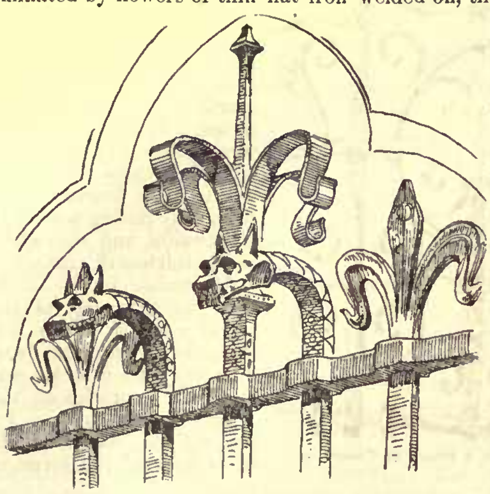


Fig. 15. From the Cathedral Cloister, Toulouse.

The uprights were often richly wrought into ornamentation both at top and bottom, with spikes and spines (Fig. 17); especially were these of use in the openings of châteaux, and were evidently designed to guard against the treacherous entry of an enemy by the windows. Fastened deep into the stonework with lead, the bars could only be pulled out after long effort and great exertion of force.

[1] Continued from No. 624, page 280.

Precautionary measures were carried so far as to suggest the framing of the uprights through the traverses and the traverses through the uprights, by means of eyes worked alternately in each (Fig. 18), so that the iron could not be slipped apart.

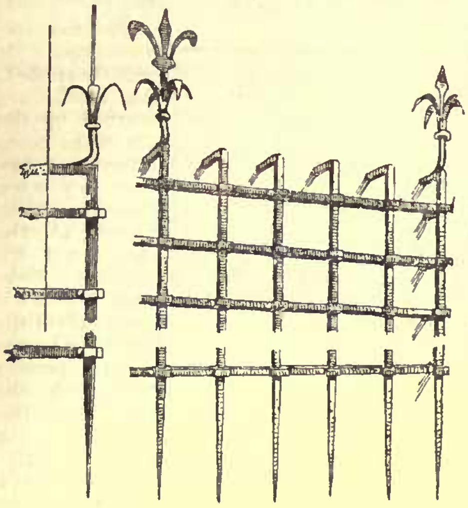


Fig. 16. From tha Chateau de Tarascon.

Only the most skilful smiths could fashion such a grille, for each enlarged eye was forged as the traverses and uprights were framed, and the grille, in a word, forged entire, each mesh being put into the fire a number of times. In fact, the workmen of that time amused themselves with difficulties which are to us insurmountable. An example of the kind described is found in a house in Constance, and others may be found at Troyes, Strasbourg, and in many places of the North and East, dating from the fourteenth, fifteenth and sixteenth centuries.

Certain grilles belonging to houses of the fifteenth century on the banks of the Garonne although well put together could not be compared in workmanship to the ironwork of the Ile-de-France, of Picardy or of Flanders.

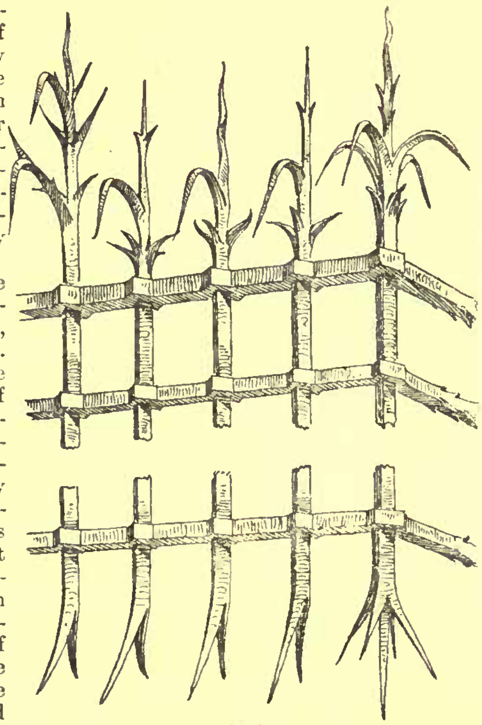


Fig. 17.

And in the Church of St. Sernin, at Toulouse, there is a grille (Fig. 19), enclosing the choir on the right of the piers of the transept, which, although well designed, is very coarse in workmanship. The uprights are roughly wrought of squared iron terminating in beaten and welded crownings, while friezes of sheet-iron mask the traverses, these friezes being edged with a little crenellation and held by rivets passing above and below the traverses, so that they are quite independent of the structure and are solely ornamental.

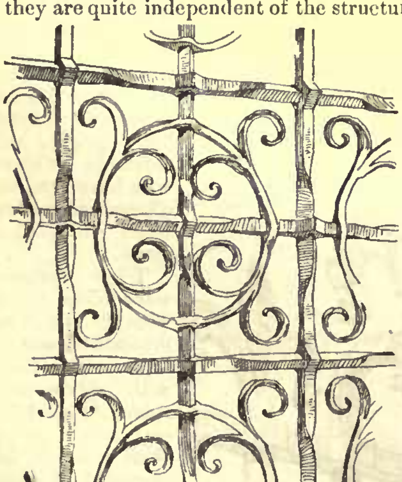


Fig. 18. From a House at Constance.

These grilles which date from the end of the fifteenth century are the first instances of applied and riveted sheet-iron taking the place of beaten and welded plates. Such simplified construction made possible a richer decoration, but tended little by little to kill out the school of smiths which had flourished so brilliantly during a part of the twelfth and the whole of the thirteenth century.

Meanwhile, in the North-east the greatness of the school was not so soon extinguished, and the ironmongery of the fifteenth and sixteenth centuries on the Rhine, in Flanders, in Switzerland, and Bavaria, is, as work of the forge, of perfect execution.

The name of the smith who forged the grilles of the tomb of Maximilian, at Insbruck, is forgotten, but his work is still superior to anything of its kind.

At the end of the fifteenth and the beginning of the sixteenth century a number of grilles of a curious pattern, were made in which the panel is formed entirely of a single thread of round iron, 0.012m., folding forward and backward, and entwining itself into many folds. With great difficulty, and the burning of many bars of iron, this grille (Fig. 20) has been reproduced for me by some of the best workmen of to-day.

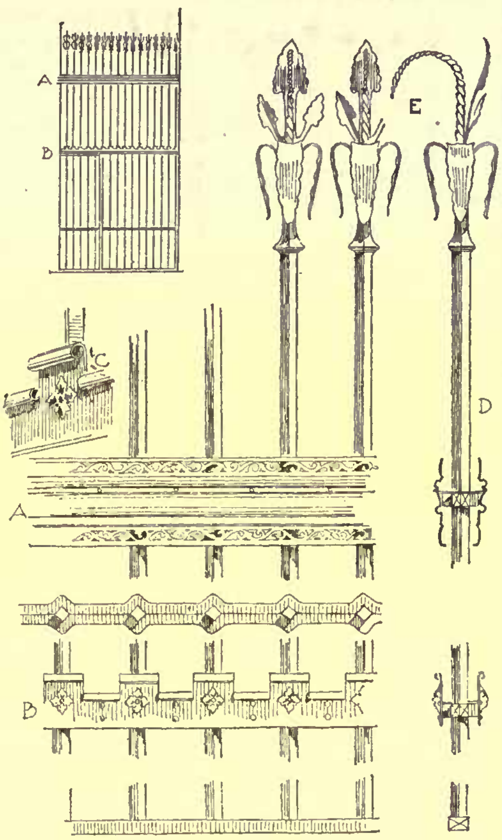


Fig. 19. From the Church of St. Sernin, Toulouse.

It was common enough in the fifteenth and sixteenth centuries to lead to the inference that its manufacture was not then of such difficulty. This grille was remarkable at once for lightness and solidity.

Our grilles, on the contrary, despite the extraordinary weight given them, have no solidity, and this because of those tenons and pins which go to make up a kind of ironwork which may best be likened to carpentry.

To have put together ironwork with mortises and tenons and pins would have seemed an enormity to the smiths of the Middle Ages and of the Renaissance.

Such methods, proper to joinery, do not accord with the nature of iron and with the dimensions which should be given to the parts of a grille.

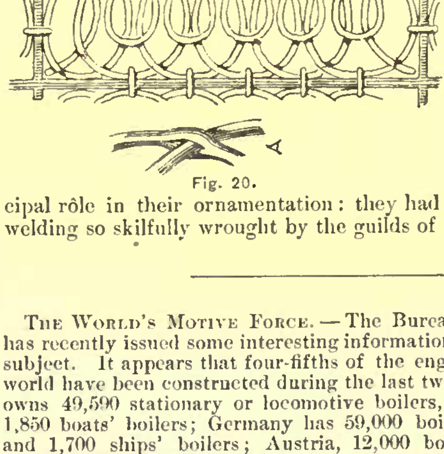


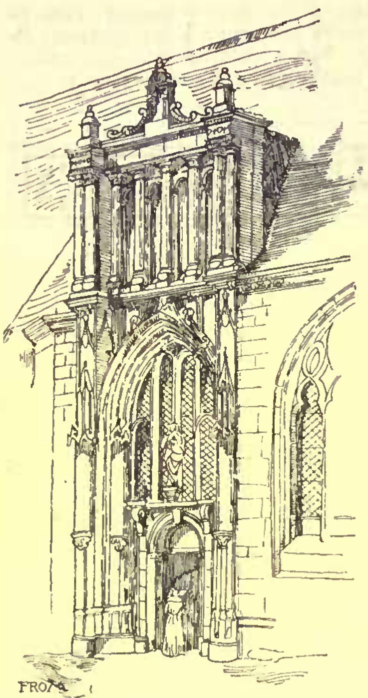
Fig. 20.

In a word, we no longer weld iron, we frame it. While the manufacture has wonderfully and vastly developed in our times, workmanship, in iron at least, has wofully retrograded from the standard of some centuries ago.

Beautiful grilles were still made in France in the fifteenth and sixteenth centuries, but riveted repoussée sheet-iron played the principal rôle in their ornamentation: they had lost the old method of welding so skilfully wrought by the guilds of smiths of the old days.

THE WORLD'S MOTIVE FORCE. — The Bureau of Statistics in Berlin has recently issued some interesting information in connection with this subject. It appears that four-fifths of the engines now working in the world have been constructed during the last twenty-five years. France owns 49,590 stationary or locomotive boilers, 7,000 locomotives, and 1,850 boats' boilers; Germany has 59,000 boilers, 10,000 locomotive and 1,700 ships' boilers; Austria, 12,000 boilers and 2,800 locomotives. The force equivalent to the working steam-engines represents: in the United States 7,500,000 horse-power, in England 7,000,000 horse-power, in Germany 4,500,000, in France 3,000,000, and in Austria 1,500,000. In these figures is not included the motive power of the locomotives, whose number in all the world amounts to 105,000, representing a total of 3,000,000 horse-power. Adding this amount to the other powers, we obtain the total of 46,000,000 horse-power. A steam horse-power is equal to three actual horses' power, and a living horse is equal to seven men. The steam-engines of the world represent, therefore, approximately, the work of 1,000,000,000 men, or more than double the working population of the earth, whose total population amounts to 1,455,923,000 inhabitants. Steam has accordingly, trebled man's working power, enabling him to economize his physical strength while attending to his intellectual development. — *London Standard.*

THE COMPETITION FOR LICK MEMORIAL, SAN FRANCISCO, CALIFORNIA.



EGLISE NOTRE DAME DE BOURGES

AS is usual in ninety-nine of a hundred cases the majority of the designs submitted in this competition fail to comply with the terms of the invitation sent out to those desirous of competing, and the result is twenty-three designs, most of which are not suited for the purpose, and, with one exception, none worthy of the location. The site is one seldom found in our cities, being a plat about seventy-five by two hundred feet, having streets on all four sides and the new City-Hall as a background, so that the group should be designed to be seen from all points.

With the site, the sum ($100,000), and last, but not least, the subjects to be represented, namely, the three decades in the history of the State: discovery and settlement; from then to advent of agriculture as the great industry of the State; lastly, the period of general industries up to the date 1874.

Certainly with the romance attaching to the first period, the wonderful diversity of products of the second, and numerous historical events of the third, one would look for some striking work from our best artists, instead of which we have not one strong, simple design.

Why is it designers cannot emulate the example of our best musical composers, taking a theme which being quiet and dignified in the few notes, with its variations, makes a sonata or fugue, or, light and graceful, a symphony or ronda movement, but always keeping the theme uppermost; instead of this we find an outline all lost in a maze of columns, heads, wreaths, panels and figures, and the central main object completely lost in the ornamentation.

Is it not possible that the mistake we American architects make is in not keeping to some one good style, Classic, Renaissance, Gothic, or whatever it may be, carefully considering what one's strongest leaning may be, and working out our own salvation in that order, irrespective of our neighbors. Certainly we should get purer work, and by the contrast of different orders obtain quite as much variety as at the present time, with a new departure about every five years.

But to return to the designs, in brief, they are as follows:

No. 1. An oblong mass of masonry, with rounded ends, rising above which is an octagonal structure surmounted by a group of dancing horses, though why the annals of the State should be so represented we know not; the design, in general, is original.

No. 2. Is of no particular merit.

No. 3. For a less important commission this would be very acceptable, being a rough boulder on which is the figure of Eureka and bear (the State insignia), and surrounded by figures representing different epochs. If these figures were grouped close to the boulder, the effect would be restful and the *tout ensemble* more dignified.

No. 4. Has no particular merit.

No. 5. Is evidently the work of an architect, being an octagonal Gothic structure with recessed panels, leaving the figures to represent the requirements and having a large finial for completion; the whole design is too labored and funereal — better suited for a cemetery.

Nos. 6, 7. Are of no merit.

No. 8. Has actually filled the terms of the invitation literally, by submitting three groups of figures, one to be slightly elevated. These groups are by far the most artistic of all the designs submitted; the figures are all easy and graceful, well brought together, and by taking a central object, such as a plain mass of any material, surmounted by a figure symbolical of the State, and placing the three groups about it, the result would be very strong and all that could be wished.

No. 9. Is very Frenchy in design, being a column and cap, a figure symbolical of the State, and a base surrounded by figures. Had the designer stopped here the effect would have been good, but he must needs add a platform with more figures, which simply by their superfluity weaken the whole design.

No. 10. Of no merit.

No. 11. Is, without doubt, the cleanest design of all submitted, having dignity, ease and purity. The base is square, having four arms, on which are the groups of figures, and rising some hundred feet a perfectly plain obelisk. One studies and studies this design, all the while wondering why it attracts so much, and it is simply the modesty and the feeling of strength that shows how satisfactory and pleasing a well-designed piece of work is.

Nos. 12, 13, 14. Are poor.

No. 15. Is, at a glance, the work of a modeller who has tried to do too much, and the result is a large collection of figures, panels and wreaths.

Nos. 16, 17. Of no particular merit.

No. 18. Low, square form, with panels, figures in bas-relief: neat and simple.

No. 19. Tall shaft, six-sided base, with six intermediate arms, on all of which are overdone and jumbled figures.

No. 20a. Is a large round shaft, and groups on pedestal, — not attractive.

No. 20b. This design is beautifully drawn, well studied, and, with exception of No. 11, the best submitted. The base is an oblong form, with a low central mass, having above a symbolical group, and on either side of the pedestal a group; the whole being very classical, neat and dignified. Had there been four arms to the pedestal, instead of two, the effect would be better, as the site is equally favorable from any point, and two groups necessarily are seen sideways.

No. 21. Is a lookout-tower of poor design.

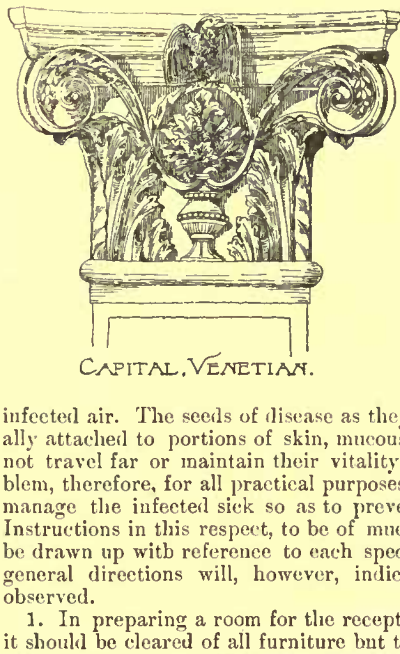
No. 22. Is a short, heavy column and cap, supporting a figure, and having a circular base with three groups. The design in general is neat, but lacks strength.

No. 23. Proposes to cover the entire plat with figures, panels, groups, etc., with a central cemetery monument, with an angel on an eagle's back on one face, and California on top, with outstretched arm, holding a horseshoe; probably half a million dollars would complete it.

It has been suggested by a very few that all the designs be rejected, and that the five authors of the most worthy be invited to submit new designs (this will hardly be done); or, better, yet, if the Lick Trustees would call in some well-known artist or sculptor, and employ him outright, San Francisco might have something else to be proud of besides its miserable streets and the ruins of its *new* City-Hall.

S.

IMPURITY OF THE AIR.[1]


CAPITAL, VENETIAN.

HOW to prevent the air being tainted by the seeds of disease, especially infectious disease, and how to remove such seeds from the air, are in some respects simpler questions than how to ventilate. At least they are more circumscribed. It is not now believed, as it once was, that epidemics travel very long distances by means of air. When plague or cholera spreads from one country to another it is conveyed by infected persons or bales of goods, not by currents of infected air. The seeds of disease as they occur in the air are generally attached to portions of skin, mucous or diseased tissue, and do not travel far or maintain their vitality long in the air. The problem, therefore, for all practical purposes resolves itself into, How to manage the infected sick so as to prevent the spread of infection? Instructions in this respect, to be of much service, would require to be drawn up with reference to each specific disease. The following general directions will, however, indicate the main points to be observed.

1. In preparing a room for the reception of an infectious patient, it should be cleared of all furniture but that absolutely required, and the floor should be cleansed and left bare.

2. The room or rooms used by the patient should be regarded as infected and cut off from the rest of the house by means of a sheet or sheets (wrung out with a disinfectant solution and kept moist therewith) suspended outside each door and reaching to the floor.

3. Everything brought into the room — as dishes, glasses, books, toys — should be regarded as infected, and nothing that cannot be readily rinsed or soaked in a disinfectant solution should be removed from the room.

4. Towels, pocket-handkerchiefs, soiled linen, etc., should be boiled in a disinfectant solution. One made from sulphate of zinc and common salt is efficient and does not stain.

5. The patient should be washed daily with a simple disinfectant and soap and water. In scarlatina, after washing, the skin may be anointed with oil.

6. There should be a good open fire in the infected room summer and winter, and, if no special ventilation be provided, the window should always be left a little open.

7. Dogs and cats and domestic pets should be rigidly excluded from the sick room, as they may readily carry the infection to the external air.

8. If the patient die, the body should be at once swathed in cloths wrung out in a disinfectant solution and should be sealed in a metal coffin before being removed from the room.

9. When the room is no longer required by the patient, the doors

[1] From a lecture by Francis Vacher, F. R. C. S., published in the *Sanitary Record*.

and windows should be carefully pasted up, and the room and its contents disinfected with the fumes of burning sulphur for twenty-four hours. The room and contents should then be left to air for a week, the windows being opened and a fire in the grate. The room and contents should then be thoroughly washed. Books and toys which cannot be washed, etc., should be burnt.

A word in conclusion as to the amount of air which should be delivered to an infected patient. With a large fire in the sick-room there is no need to be afraid of supplying air too freely. I have said that 3,000 cubic feet per hour has been fixed as the amount required for a healthy adult; it is obvious a sick adult should have more than this. At the new Hôtel Dieu in Paris which I visited, 3,500 cubic feet per head per hour are delivered, and the wards are certainly not free from the ordinary hospital odor. According to Dr. Sutherland, 4,500 cubic feet should be allowed in an ordinary or surgical hospital where there are many bad cases. For an infectious patient, it appears to me reasonable to try and obtain 6,000 cubic feet per hour. To get this amount without draught, when no special mechanical contrivance is available, the capacity of the sick-room should be about 2,000 cubic feet — the air-space now officially required per head in infectious wards.

COMMUNICATIONS

THE PROPORTIONS OF CHIMNEY FLUES.

SANFORD, FLA., Dec. 9, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — Is there any authorative work published that will give proper proportions of flues for open fireplaces, furnaces, boilers, etc., if so, will you kindly advise me, name, publisher, etc., and oblige, Yours very truly, WILLIAM T. COTTER.

[“*The Open Fireplace in all Ages*” by J. P. Putnam. Ticknor & Co., publishers. “*Tall Chimney Construction*” by R. M. and F. J. Bancroft. John Calvert, publisher, Manchester, Eng. — EDS. AMERICAN ARCHITECT.]

ADVICE TO STUDENTS.

MINNEAPOLIS, Dec. 8, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — As you are interested in the welfare of young architects and as I feel confidence in your peculiar position to advise me in the matter of this note I have taken the liberty to make it purely a letter of inquiry. I have just entered the office in the position of a student. The state of my finances not warranting a course at a technical school I have sought to gain such a knowledge of the occupation of my choice as may be found in office practice, in real life. Now what I feel most keenly is the need of *directed, profitable, individual* work outside of that which I am required to do as assistant in the office, namely, tracing, copying specifications and the like. At the schools, the instruction is mainly through lectures which I cannot get. It is begun, I believe, by attacking the orders. Now what is this for? Its aim? Its end? I find my employer has forgotten nearly all of that drill — can not make a column extempore. What should be my *practice* in this direction and degree of proficiency? Then what is the next branch considered essential, and which I should try to master. I — as brother students must, also — deplore the fact that we can obtain no hand-book, manual or “*vade mecum*” for students. I earnestly desire that you will be prompted to consider the cause of office students and aid us with your knowledge and experience. Another matter of importance is the fact that no person can attend a course at an architectural school without passing an entrance-examination embracing studies which he has dropped, for sterner duties long ago. Is this not the case? If in a year or so I should see my way to attend school, how am I to get admission. Is this just to a faithful earnest seeker for that improvement which is offered and advertised by the institutions? Awaiting your reply with interest, I am, Most truly yours,

RICHARD H. KEEP.

[THE greater part of our correspondent's questions can be answered by referring him to a series of papers on “Architectural Students” by the original editor of this journal, published in this journal between September, 1876, and March, 1877. Bound copies can probably be found at the public library. As to the examination question, while it has disadvantages for the student, it has serious advantages for the school. Originally, the Massachusetts Institute of Technology received “special” students in architecture without examination, but it was found that with the serious-minded workers came a great number of lazy and indifferent pupils to whom the fact that no examination was to be passed was the all-important factor in deciding them to honor the school with their rather burdensome presence. — EDS. AMERICAN ARCHITECT.]

MR. VAUX AND THE NEW YORK PARKS.

BROOKLINE, Dec. 10, 1887.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — In a paper of your issue of Dec. 3d, an impression appears that Mr. Vaux's part in the design of the large parks of New York and Brooklyn was in some degree a secondary one. Its origin may be found in the circumstance that before the plan of the first of these parks was begun to be devised Mr. Vaux's associate in the designing of it had been elected to the office of superintendent of the park. The responsibility of superintendence remaining with him individually after the adoption of the plan, as the park came to be an institution of general interest, his name was brought more familiarly before the public. The notion that his was the leading mind in the design of the work followed naturally but unjustly.

O.

NOTES AND CLIPPINGS

A LARGE TIMBER RAFT. — The great raft was successfully launched at Two Rivers at noon, November 15, and now lies at anchor in the bay awaiting the arrival from Halifax of the steamship “*Miranda*,” which has been chartered to tow the monster to New York. James D. Leary, of New York, who is agent for Daniel J. Leary, owner of the raft, arrived on the scene this morning. The raft is 585 feet long, 62 feet wide, and 37 feet deep, and weighs 9,000 tons. There were four ways 1,200 feet long, and the raft went slowly at first; but, gathering speed, ran 1,000 feet until she floated. She made the run in 34 seconds without the slightest strain, did not part a single chain, nor spring the vast structure an inch. She was taken in tow by the tug Neptune, and the cradle removed. The raft draws 19 1-2 feet, or 6 feet less than was expected. The launch was made under the superintendence of H. R. Robertson and Martin Hawkins, of New York, foreman for Mr. Leary. Leary and Robertson are sole owners for the patent. It was in 1883 that Hugh R. Robertson, of this city, conceived the idea of building a raft somewhat in the form of a ship, composed of logs cut in full lengths and firmly secured by chains. In the following year Mr Robertson drew a plan of the proposed raft and patented it in the United States, Canada, Great Britain, Norway, and Sweden. Early in 1885 Mr. Robertson visited New York and contracted with Wilson Godfrey for the construction of a raft afloat on the shore of the Bay of Fundy. In November of the same year, B. B. Burnhill, of Two Rivers, Nova Scotia, contracted to furnish the lumber required for the raft, and to build it ready for launching, according to plans and specifications prepared by Mr. Robertson, a change having taken place in that gentleman's relationship with his employer. Mr. Burnhill began to prepare a place for the raft near the head of the bay — a place called “Finger Board,” about six miles down the bay from the Joggins and about three from Shulee. The spot was admirably adapted for the purpose, and soon workmen were engaged in the construction of the raft. The raft was completed in August, 1886, and was almost as large as the Great Eastern, and full a third heavier. It contained over 2,000,000 feet of lumber, being over 400 feet in length, 50 in width at the centre, and 33 in depth and 25 in diameter at either end. On the 31st of July, 1886, the first attempt was made to launch the raft, but it did not move. A second attempt was made the following day, and the large mass ran down the ways nearly 200 feet. There it remained owing to the breaking of the ways. Several other attempts were made to launch the raft, but without success. Then Mr. Robertson, who felt satisfied of the practicability of the scheme, decided to tear it apart and rebuild it. This was done, and the new raft was finished a few days since. It is much larger than the first structure, being over 500 feet in length, and containing about 3,000,000 feet of timber. Its general form resembles that of a fat cigar, somewhat flattened at its upper and lower sides, with the pointed end cut off. It is one solid mass with the exception of moveable interstices necessary in the packing of round lumber, in trees cut as long as they grow, from 30 to nearly 100 feet in length. The timber has been stowed with its small ends generally toward the ends of the raft, which helps to give the proper taper, and it is so interlapped that great strength is attained to hinder the structure breaking in two. The patentable point in this system of rafting is the adjustment of the chains which bind the whole together. The main or centre chain runs from one end of the raft to the other, and it is by that the structure is to be towed. The lateral chains are used to prevent the raft from working apart longitudinally by the action of the waves. The encircling chains are attached to the lateral chains, and are to prevent the raft from flattening out while afloat.

The raft is now afloat, and if it can be towed to New York, possibilities will be shown in the lumber business never heretofore dreamed of. The tug Neptune, of this port, is at the place now watching the raft, which is anchored. — *Halifax Paper.*

THE MEXICAN SULPHUR MINES. — A letter from Mexico to the Brooklyn *Times* says of the production of sulphur: “In view of the value of sulphur deposits of Popocatepetl, it seems incredible that they have not been more thoroughly worked. At present Sicily is the principal source of the world's sulphur supply, that country producing more than four-fifths of all that is consumed on the globe. The deposits of “old Popo” are much greater than that of Sicily and of better quality, and can be brought to market — at least in the United States — twenty-five per cent cheaper than the Sicilian. Aside from that consumed in Mexico more than 200,000 tons are annually used in the United States, and even if every ton of Popocatepetl sulphur were sold at twenty per cent below the usual price, there would still be a clear profit—after allowing for freightage and all other expenses, of not less than two dollars per ton. The expenses of production are very small. The workmen receive seventy-five cents per arreba (25 pounds) for bringing up crude sulphur from the interior of the mountain and delivering it at Flamacas. This work is exceedingly laborious and full of danger; not only are huge rocks constantly rolling down the sides of the crater, threatening to engulf the tiny windlass and crush the atom of humanity being lowered into the depths by a frail rope, but the sulphurous vapors and exhalations are extremely injurious to the health. The workmen remain in the crater a month at a time, eating and sleeping in that inferno, after which they are hauled up and their places supplied by others. It is

said that in a short time their teeth fall out and their hair drops off their heads like bristles from a scalded pig, and the man who goes down in the stoutest of oxhide boots and the stoutest of new clothes, comes up at the end of the month in the dilapidated condition of Rip Van Winkle after his twenty years' nap.

The Schloss of Fredensborg. — "The Schloss of Fredensborg is one of those huge barracks which Continental sovereigns were fond of erecting till the middle of the last century, when the French style became universal in Europe," says the London *World*. "It contains nearly four hundred apartments. There is an immense hall, and also a great room called the dome hall, which has usually been the dining-room during the last three months. The library and saloon are fine rooms, but the rest of the palace is divided into suites. The Emperor and Empress of Russia had five rooms facing the park, of which one, used as a study, contains a large painting of Catherine II. The Princess of Wales had a charming suite of three rooms, the *salon* entirely furnished with walnut. The Queen's apartments, which are splendidly furnished in the style of the last century, were the usual sitting-rooms in the morning and after dinner. The whole palace was crowded, what with royalties' suites and servants, and the Crown Prince and Princess occupied a house in the gardens. The rooms are plainly, and, indeed, barely furnished, and the palace is evidently intended only as a summer residence."

What a London Fog Costs. — "The cost of a single day of fog to the gas-consumers of London may be gathered from figures compiled from official sources," says the London *Standard*. "Wednesday was a day of dense and continuous fog, necessitating the extensive use of gas, and on that day the quantity of gas supplied to London by the Gaslight and Coke Company amounted to 103,664,000 cubic feet, or 35,000,000 cubic feet in excess of the quantity sent out by the same company in the corresponding day of last year. The above excess in the supply of gas would represent the supply to a town of from 10,000 to 12,000 inhabitants for a whole year. In addition to the quantity supplied by the company mentioned, there were supplied by the other two Metropolitan Companies — the South Metropolitan and Commercial — about 45,000,000 cubic feet, making a total consumption for London on a day of fog of nearly 150,000,000 cubic feet. Approximately, the value of this gas was £21,000, of which cost from £7,000 to £8,000 was directly due to the fog. In 1885, on a day of similar fog, a great strain was put upon the companies."

Life Insurance for Two Cents. — "Drop a nickel in the slot and insure your life" is a legend which may soon be looked for in the saloons and railroad stations throughout the land. What with musical locomotives and steamboats, and machines for testing weight and height and strength of muscles and lungs, besides automatic deliverers of candies, cigarettes and stationery, the possibilities in this line would seem to have been well nigh exhausted, but now comes a new London corporation, the Automatic Accident Insurance Box Company, with a capital of £60,000, which proposes "to provide the public with a ready means of obtaining an insurance for twenty-four hours against death arising from accidents of every description, by simply placing a penny in the slot of a box." It is proposed to place 1,000 boxes as quickly as possible in various parts of London, and subscriptions are now invited for 40,000 shares of £1 each, the balance — 20,000 — being taken by the vendor. What next? — *Spectator*.

How a Telegraph Line was protected from Native Curiosity. — According to the *Electrical Review*, when the electrical telegraph was first introduced into Chili, a stratagem was resorted to in order to guard the posts and wires against damage on the part of the Araucanian Indians and maintain the connection between the strongholds on the frontier. There were at the time between forty and fifty captive Indians in the Chilian camp. Gen. Pinto called them together, and, pointing to the telegraph wires, he said: "Do you see those wires?" "Yes, General." "Very good. I want you to remember not to go near nor touch them; for if you do, your hands will be held and you will be unable to get away." The Indians smiled incredulously. Then the General made them each in succession take hold of the wires at both ends of an electric battery in full operation. After which he exclaimed: "I command you to let go the wire!" "I can't; my hands are benumbed," said the Indian. The battery was then stopped, and the man released. Not long afterwards the General restored them to liberty, giving them strict injunctions to keep the secret, and not to betray it to their countrymen on any account. This had the desired effect, for, as might be expected, the experiment was related in the "strictest confidence" to every man of the tribe, and the telegraph has ever since remained unmolested.

Architects, Clients, and Builders. — It is a principle of law and equity that an agent is not allowed to make any profit out of the agency, without the knowledge and consent of his principal, beyond his proper remuneration; and any sums of money so obtained by an agent from any other source must be accounted for to the principal, who may claim it as money received to his use. Where, therefore, an engineer (and this case again equally refers to an architect) entered into a sub-contract with the contractor without the knowledge or consent of the employer, it was held that any surreptitious dealing between the contractor and the engineer was a fraud, and entitled the defrauded employer, if he came in time, to have the contract which was entered into without his knowledge or consent rescinded, and to refuse to proceed with it in any shape. So, on the other hand, the architect should not, without the knowledge of the builder, enter into a contract or engagement with the employer. If, besides the contract between the employer and the builder, there is a contract between the employer and the architect, not communicated to the builder, that the outlay shall not exceed a given sum, and the builder is, by the contract, subject to the orders of the architect as to what works he shall execute, this agreement is not binding upon the builder, and such restriction of the architect's authority by contract, as agent for the employer, cannot in any respect prejudice the builder's rights. And in order to enable the employer to claim the benefit of a proviso that the architect was to arbitrate in all matters between him and the builder, it is essential that the fact of such a contract as above mentioned, between himself and the architect, should have been communicated to the builder, and distinct notice of such an engagement given to him previously to his entering into any contract, as otherwise the architect would be put in a position of undue bias. If, however, the builder was aware of the agreement between the architect and his employer, and of the fact of the architect's interest in consequence, the builder would be bound. — *Alfred Emden, in the Architect, London.*

TRADE SURVEYS

Business in all parts of the country continues at a higher point than traders and manufacturers would have predicted ninety days ago. The iron-trade barometer points to clear weather and plenty of business. Railroad earnings on 101 roads for eleven months show an increase in gross earnings in round numbers of $35,000,000 over the earnings of the same time last year. Only four roads out of the 101 show a decrease. The November earnings this year are as $30 to $26 for same month last year. High railroad authorities have stated within a day or two that there is not as much cause for a curtailment of railroad-building operations next year as many newspapers writers and guessers of probabilities think. They state that there is so much territory yet to be covered by railroads, and which can be covered more cheaply now than perhaps three years hence, that it is wise not to wait for another boom in material, but to take advantage of low prices to push ahead. The necessity for covering territory is the strongest inducement to railroad construction where immediate returns cannot be relied upon. There is an outpouring of population from the East, which is silent and unobservable. There is a more important factor than is apparent. The region west of the Mississippi is quietly filling up by a thrifty population that has money to see it through any ordinary depression. Then, again, industries are being diversified, and instead of all-wheat, all-corn, or all-cotton crops, there is a diversification which enables the new comers from the East Mississippi region to utilize their labor twelve months in the year, and to make money even though the wheat and corn crop should show a decline enough to depress prices, if such were the fact. There are a great many factors beneath the surface which must be studied in their full significance before a really intelligent opinion of probabilities can be formed. The best authorities in this city, New York and Chicago justify the statement that there is a broad field for future railroad-building in this country, and that those who wait a year or two will be the first to have cause for complaint at their extreme caution. Even in the Northwest where a 20 per cent reduction in traffic rates threatens a ten million reduction in gross earnings, there is a good deal of railroad-building projected, and it will be, in all probability, entered upon. Within the past thirty days between two and three thousand miles of road have been projected in the region south of the Ohio and in the Southwest. The peculiarity of railway construction next year will most probably be the building of small lines and feeders ranging from ten to fifty miles in length, to develop territory offering special inducements for railway-building enterprise. The makers of machinery have as good opportunities of judging of future probabilities as any other class of men. The heaviest makers in the New England and Middle States could not be induced to state over their own names that there will be a serious curtailment of activity. Taking the locomotive-works we find there are prospects for an unusually active year. It will require some very serious obstacle to induce railroad-managers to reduce expenditures for locomotives, cars, equipments, stations, side-tracks, and a variety of other improvements which increased traffic has rendered necessary. With all the activity that is visible and probable, there is still room for a very conservative management. It must be admitted that margins are narrowing down in nearly every branch, but there are elements of safety which will prevent the pendulum from swinging beyond a safe limit. The little shops and shop-keepers are all doing well. A great deal of new work has appeared in sight within thirty days. The nail-makers are, of course, facing low prices. Bar-iron makers have completed the bulk of their orders, and are awaiting new ones. Iron and steel plate-makers will be in the market in January. Western machine-shops and tool-works are slackening up a little, but the dulness will not last much beyond the middle of January, according to some of the statements of some of the leading managers in those lines. The anthracite-coal-strike will probably come to an end before midwinter. The assessment made by the leaders of the strike is misleading the strikers into the belief that they will win. In a very short time stocks will begin to accumulate at New England points, New York and Philadelphia. The production last week was 55,000 tons ahead of the same week last year, in spite of the large number of idle men. The production for the year is in round numbers 2,400,000 tons ahead of last year. The confidence of the business men of the nation does not seem to have been seriously shaken by the high official utterances, and the future course of the Government in regard to economic legislation. The business men of the country have more confidence in the stability of business than years ago. Even if they should see a general reduction of duties in sight, it would not have the effect that an announcement of such a policy would have had five years ago. The necessity for tinkering is recognized, and the inevitable tendency for greater freedom of international intercourse is making many of those who were heretofore antagonistic to such a policy more friendly to it if made in the right spirit. The reports during the past week from large builders in our leading cities, show that the statements made regarding winter and spring activity were not premature. All probabilities point in the direction of activity. Country-building requirements will be very carefully entered upon. This will include a certain amount of small house-building, the demand for which is certainly in excess of the supply. In the West there is a feeling of confidence in building enterprise. The industrial activity of half a dozen railroads, the active demand for mineral, iron, steel and lumber, and the growth of a multitude of towns into little cities, all help to strengthen confidence, and to give money-lenders in the East more faith in the West, and in its permanent ability to make good all loans.

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HELIO-CHROME

DRILL-SHED, QUEBEC, CANADA.

J. B. DEROME and E. E. TACHE, Architects.

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CONTENTS

A RATHER interesting case was tried in New York a few days ago, which illustrates in an instructive way the impression which juries, and the public generally, have of architects of a certain class. It seems that Mrs. Jeannette Thurber, the principal director of the American Opera Company, while travelling during the summer from her country house to New York, met on the train an architect, who appeared to take great interest in her pet musical schemes. She was pleased with his enthusiasm, and discussed with him at considerable length her ideas in regard to an opera-house for her company. So far as can be gathered from the newspaper accounts, the architect suggested that he might make some sketches for the building, according to the ideas which had been under consideration, and Mrs. Thurber assented. According to her testimony, she told the architect that if the opera-house was built, there would be a competition for plans, but that she would use her influence with the directors to have his designs adopted; but the architect seems to have forgotten this, and, a year or so afterward, he sent Mrs. Thurber a bill of thirty-seven hundred and fifty dollars for his services in making them. We wish to call attention to the fact that if a person should spend hours in talking on a train with a lawyer about his affairs, and should accede to the lawer's proposition to draw up a brief, he would almost infallibly find himself compelled to pay the lawyer for the conversations as well as the brief, at whatever rate the lawyer saw fit to charge; but an architect, in the public estimation, is a very different thing from a lawyer, inasmuch as he is supposed to be afflicted with a disagreeable propensity for forcing plans and sketches upon unwilling persons, which juries think it their duty to curb; and this object is usually attained, by assuming, in all cases of doubt, that the architect enjoys working for nothing, and ought not to be paid anything for what he does unless it should be proved, by some singular exception, that his services were sought, instead of being thrust upon his client. In the present instance, the jury, being persuaded that the sketches were to some extent volunteered, brought in a verdict for the defendant, leaving the architect to add the costs of the suit to the expense of making the drawings, and charge the total to the account — a pretty long one with most young architects — of valuable experience.

IN some mysterious way an underground railroad is said to be on the point of construction in New York. Most people suppose that in order to get permission to build any kind of railway in that city it is necessary to wait years, and spend enormous sums of money in bribes; yet the promoters of this enterprise seem to have secured a right of way without opposition, by taking advantage of some general law. The line of the road is to be from the Grand-Central Station, at Fourth Avenue and Forty-second Street, southward through Fourth Avenue and Elm Street to the Post-Office, and the transit will be made by express trains in seven minutes. It is intended to build four tracks, of which two will be used for express, and the others for local business, and the line will eventually connect, it is supposed, with the tracks through either the Hudson River tunnel now building, or with those of another tunnel, which it is already proposed to make, through the rocky portion of the river-bed opposite the Pennsylvania Railroad Station. It is rather unfortunate that the scheme should have been taken up just as the Arcade Railway Company, after twenty years of struggling, has overcome all the difficulties in its way, and begun operations; but, although the stockholders of each road will have to be content with smaller dividends than they would get if the other line did not exist, the public will be benefited by having a choice of two lines, and the enormous longitudinal traffic of New York will probably support the two tunnel lines comfortably, besides all the elevated roads. The Vanderbilt family is said to be interested in the new tunnel, and in that case it will probably be constructed with a view to connecting as speedily as possible with the Pennsylvania and other railroads across the river. This seems to have been a favorite scheme of the famous old Commodore Vanderbilt, and it is certainly time that trains should pass through New York in some better way than by being transferred on ferry-boats around the city.

THE *Sanitary News*, which has a happy faculty of collecting useful articles on hygienic matters, publishes a paper on "House-Building from a Surgical Standpoint," by Dr. H. C. Wyman, which contains more common-sense than we have often found compressed into six small newspaper columns. The author begins by saying that he is tired of the everlasting harping which resounds on all sides upon traps, drains, sewer-gas and ventilation, and would like to hear something said about those imperfections in dwellings which do not come within the plumber's province, and which, he might probably say with truth, cause quite as much disease and suffering as the so-called "sanitary defects." Among the blunders of this sort which are responsible for unnecessary suffering, he regards badly-planned and badly-constructed staircases as the worst. Very commonly, perhaps usually, these are too steep; they are generally badly arranged, presenting dangerous turns, and being often so dimly lighted as to increase their perils tenfold, and, even where properly planned, they are very commonly made of hard wood, without carpeting, and, in consequence, often inflict dreadful injuries upon those who have the misfortune to fall upon them. Steep stairs he finds to be peculiarly dangerous to children. Even if they do not fall down them, the shock to the hip-joint caused by the sudden drop upon it of the body of a young child, repeated at each step as the little one descends, is, as he says, "one of the surest means of producing the dread calamity known as hip-joint disease," and the care which induces an older person to lead a little child down such stairs rather adds to this risk, by causing it to drop quickly from step to step, half suspended from its protector's hand, instead of climbing down slowly in the manner natural to it, holding by the balusters. As to stairways which wind or are dark, Dr. Wyman says that they are "veritable pitfalls," on which a person unaccustomed to them is "certain to make false steps and fall," and he mentions "innumerable bruises, wounds of the scalp, abrasions of the face, fractures of the jaw, of the leg, of the arm and of the thigh," which in his experience have resulted from this cause. Even if the stairs are easy and well lighted, he believes that where used by children they should always be padded and carpeted, for the reason that children, in the falls which they are certain to get, "are very apt to stumble and strike upon stairways in such a way as to produce concussion of the spine," laying the foundation for the most serious and painful disease and deformity, and a precaution which, like this simple one, will obviate or lessen so terrible a risk, is to be earnestly recommended.

IT would take too long, and would hardly be fair to the *Sanitary News*, to quote too copiously from this admirable paper, but as some of our readers may not be able to consult it, we will, in the interest of the public, mention some of the other things which Dr. Wyman speaks of. Next to the stairs, he finds the floors, perhaps, most open to a surgeon's criticism. To say nothing of the unexpected steps between rooms, over which we have all probably come so near breaking our necks in old country houses as to need no warning, he finds the

thresholds still commonly used under doors very objectionable, denouncing them as "relics of barbarism which have occasioned more broken heads and noses than all the shillelahs of old Ireland," and should be torn out of the houses where they still exist without further delay. Besides these, floors are apt to contain splintered boards, which not only cause serious wounds to the feet, but often, where young children creep about over them, penetrate the hands and even the knee and ankle joints, setting up "most serious disease." After speaking of sash-windows of the "guillotine" pattern, as they are aptly called abroad, and the ways in which they endeavor to deserve their name, Dr. Wyman calls attention to the evil consequences following the use of defective or poor keys, bolts and knobs. Bolts that refuse to slide and knobs and keys which are indisposed to turn very often, as he says, cause felons through the effort applied to them, which bruises the soft structures overlying the bones of the fingers or hand, occasioning inflammation, and determining the formation of an abscess, which, after weeks of agonizing pain, frequently leave the finger or hand distorted and useless for life.

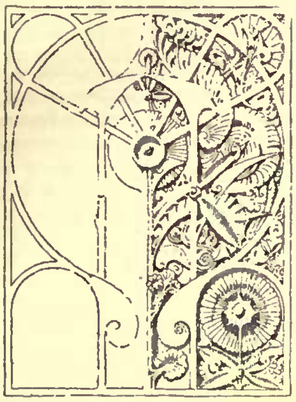
LIEUTENANT ZALINSKI'S dynamite-gun has caused a surprising amount of commotion in the military world, hardly less, in fact, than that occasioned among naval officers by the appearance of Captain Ericsson's "*Monitor*" in the waters of Chesapeake Bay. Naturally enough, the prospect that in the next war among civilized nations both sides will fight by hurling shells containing half a ton of dynamite five or six miles through the air at the object they wish to destroy excites grave apprehensions in the minds of those officials who have the care of costly fortresses, which such an attack would demolish in a few minutes. To take a single example: the best models of the modern fortress in existence are, perhaps, the two which guard the entrance to the Nieuwe Diep, the great Dutch naval-station. Holland, which has its colonial possessions to defend, is one of the principal naval powers in Europe, and its best harbor is naturally protected with the best engineering skill, which has devised for the purpose two little forts, resembling turtles more than anything else, which were, before Lieutenant Zalinski's successful experiments, practically impregnable. Each turtle consisted of an inverted basin of iron or steel, enormously thick, and sheltering two or three huge guns. No projectile could penetrate the shells, and few ships could resist the fire of the guns under them, so that, so long as the men remained at their posts, no hostile vessel could approach the mouth of the harbor. With the dynamite-gun, the conditions are now entirely changed. Although its range is comparatively short as yet, a vessel armed with it could creep near under cover of darkness or fog, and a single half-ton shell of dynamite exploded on top of each fort would silence it completely, leaving the way clear for the enemy to enter the harbor and make havoc of the splendid ships and storehouses collected in and around it.

FOR this reason, an old French naval officer, the Commandant Mougin, has, with characteristic French quickness in perceiving the consequences of the new mode of warfare, published a pamphlet on the relation of the new explosives to the art of fortification, which forms the subject of an interesting review in *Le Génie Civil.* According to him, the enormous effect of a heavy charge of high explosives in throwing out earth or shattering masonry renders it necessary to abandon these materials as means of resistance to the new artillery. Even the steel turtle-shells, still indispensable as covers for the guns, must no longer be relied upon to protect the men, who should find a place of refuge close at hand. For this purpose, he thinks the fortification of the future should consist of a low dome, nearly buried in the earth, and consisting of a shell of concrete at least thirty feet thick. This, for the present, will resist any available projectile, and the structure should be furnished with several interior towers, built up from the pavement, and carrying steel shells on top, under which the guns will be mounted. No ditch should, in his opinion, surround the "carapace" fort, but the approaches to it should be commanded by machine-guns, mounted in towers, which would easily keep assailants at a distance. It must be confessed that the interior of the carapace will not furnish a very inviting place of abode, even in comparison with the casemates of a fortress of the present day, but the Commandant Mougin proposes to make it cheerful by filling it with machinery of all sorts, for turning the guns, renewing the air, driving elevators, and furnishing electric light to all portions of the structure, as well as for illuminating the surrounding country at night, so as to prevent nocturnal surprises.

M. MAX DE NANSOUTY, the accomplished editor of *Le Génie Civil,* writes for that journal a rather striking comparative notice of the methods in use in the construction of what may be called the two rival aspirants for the place of the greatest works of engineering in the world — the Forth Bridge and the Eiffel Tower at Paris. The former of these gigantic structures is now well advanced. The foundations of the piers are in place, and the enormous cantilever arches, seventeen hundred feet each in clear span, already tower far above the water of the estuary. As is well known, the cantilever construction requires no staging or "false works," and the main piers being now practically complete, nothing more is necessary but to build out from these until the corresponding portions of the two cantilevers meet over the middle of the abyss. In doing this, M. de Nansouty observes that numerous drawings are kept on the ground; the pieces of iron are brought from the shops in a very unfinished condition, and are, after arriving at the work, trimmed, drilled, reamed and fitted with considerable trouble, to make them correspond with the drawings and occupy properly their destined places, while gussets and patches are cut out and drilled on the spot. All this is, of course, perfectly legitimate and perhaps necessary, but M. de Nansouty is much impressed with the contrast between the noise and bustle involved in this way of doing things and the quietness with which the Eiffel tower is constructed. In the French work there is absolutely no fitting, trimming or drilling. Even the use of a drift-pin or a reamer to bring into accord two rivet-holes not punched exactly in the right place is forbidden, and the workmen have strict orders to return to the shop every bar, rod or angle-iron which does not exactly fit its intended place when received. Of course, such accuracy as this requires great care in laying out the drawings for the work, and, in fact, in the shop at Levallois-Perret, the countless drawings have all the dimensions shown upon them figured by calculation to four places of decimals, the greatest error permitted in the figures being one-tenth of a millimetre, or about one three-hundredth of an inch. Of course pieces made in this way come together like the parts of a watch, and every portion is numbered and labelled, so that there can be no mistake as to its proper position, and the handling of huge detail drawings on the ground is unnecessary. The work of setting up being thus reduced simply to riveting, it is only necessary to keep a small gang of men employed, and the huge tower grows rapidly, but silently. In regard to the rumors which have been spread from time to time, to the effect that the men engaged on the tower had shown so much terror at being obliged to work so high up in the air that the project was about to be abandoned, M. de Nansouty remarks that these apprehensions have arisen only in the imaginations of persons ignorant of the subject. To the men themselves the idea that it made any difference whether they worked one foot or a thousand feet above the ground would appear exquisitely ridiculous, long practice having given such persons abroad, as it does to bridge-building gangs here, nerves proof against dizziness under any circumstances. As an illustration of this, a story told by the engineer of the Niagara cantilever bridge is worth repeating. This structure, it is hardly necessary to say, spans at an immense height the lower rapids of the Niagara River just above the Whirlpool, in a place where the force of the current is so terrific as to pile up the water in the middle of the stream so much higher than at the sides that a person standing on one bank cannot see the other. After the cantilevers on each side were in place, and before the central girder was hung between them, a single plank was pushed over. The plank was not secured in any way, and the engineer, fearing that the men might venture upon it before it was secured, and fall off, gave notice that any one who went upon it would be discharged at once. The warning bad hardly been given when one of the best of the workmen, who had either failed to hear it or could not believe it to be intended seriously, coolly walked out on the loose stick, surveyed the chasm for awhile, and then stooping down, *stood on his head* in the middle of it, and finally came ashore as if nothing had happened. For the sake of discipline the engineer was obliged to discharge him, but he did not let him go far, and in a few days found means to reinstate him.

NOTES OF TRAVEL.

CHICAGO. — I.



From McVickar's Theatre.

THERE are many people in this country, mostly inhabitants of the Eastern States, to whom the name of Chicago suggests nothing more than a breezy individuality of style, a touch-and-go manner of treating the most serious themes, a lack of Beacon-Street culture, and a condition of art in general and architecture in particular which they indefinitely describe as "Western." And again, there are others, quite as numerous, mostly living within the shadows of the Rockies, who look to Chicago as the epitome of all that is best, truest and most perfected in science and art. It is not for us to determine the exact mean between two such extremes, but the man must be blind indeed, come he from the East or the West, who cannot find plenty to admire in the lines of art and industry in that beautiful city of the West. Eastern critics have in past years endeavored to snub Chicago, but the city has, nevertheless, kept up its growth in a manner which no one can fully appreciate who has viewed it only from a distance. No one could ever accuse the West of being backward in the acceptance of new ideas, and while such a disposition is not an unmitigated blessing, it forms part of the spirit which has enabled Chicago to grow in half a century from a mere squatters' settlement to the third largest city in the country, and to plant its magnificent public buildings on the worst site Nature ever prepared for man's purposes, creating a wealthy metropolis of which the State has every reason to feel proud.

No Eastern man can visit Chicago without imbibing a measure of the enthusiastic vigor which seems inseparable from the city and which prompts the eager acceptance of all things new, the mistrust of all things ancient, even though the old has been proved worthy and the new be not the best. Chicago architects will never come to a standstill in their professional growth while the great city is booming about them. It is not too much to say that already they are at the very head in the lines of pure construction and the planning of the huge office-buildings which dot the city in every direction, and if Chicago does not win an equal position in the lines of artistic design, it will not be for lack of hard, persistent effort on the part of her art-workers. A visit to Chicago is like a sort of intellectual tonic. It puts new thoughts into one, starts new inquiries, and stimulates a more vigorous activity, to an extent no other city in the country can equal. It is not strange, then, that visitors should usually leave the city filled with a very glowing enthusiasm for some things Western.

But however proud the Chicagoans may be of their city, they must draw the line about the City-Hall. Not even the most kindly-disposed critic can claim for that unwieldy, ill-digested pile any architectural merit save that of mere size. It is big — real big, to use a Yankeeism, and it looms up in very grand proportions along Clark Street with its huge Michael-Angelesque columns and its brawny cornice, which is said to at times have a habit of breaking into fragments and dropping on the heads of passers-by; but the detail is crude where it should be bold, coarse where it should be refined, and commonplace at the best, while the general scheme is so hopeless that the local architects wisely refrain from attempting its defence. The old Court-House, which stood on the same site before the great fire of 1871, was a more satisfactory building than ever this one could be. But then, the day has not yet arrived when architectural excellence can be expected in public buildings, East or West.



Theatre-goers will be surprised to find in Chicago one of the handsomest and best-arranged theatres in the country. McVickar's is not a new house throughout, though after Messrs. Adler & Sullivan, the architects, had completed their alterations a short time since, there was so little left of the old house that McVickar's can fairly be called new in its present form, and it is certainly up to date in everything that concerns convenience of access or artistic design. The theatre is entered through a short, wide vestibule leading up a few steps and directly into the broad passage in front of the auditorium. The seats are arranged in the ordinary manner, with the exception that every seat commands a good view of the stage, a condition which does not exist in every theatre. It is, however, the decoration of the interior which attracts most attention. The general effect of color is salmon and dull bronze. The tones on the walls start from the bottom with a decided salmon tint as a ground, fading out as it rises, until in the centre of the ceiling it becomes a delicate buff. Over this is a large pattern formed in relief with heavy rosettes like the centre of a sun-flower, and lines of long, flat, spikey leaves, touched up with strong, red bronze, the pale salmon, however, remaining the principal color. This decoration is carried over nearly all surfaces, no distinction being made between walls, beams and ceilings, except by accentuated lines, rosettes or varied ornament in relief, or by using slightly deeper tones of the general color. The columns and the girders under the galleries are of a deep bronze or rather brass tone. The corridors are finished with a very effective combination of pale blue and bronze, and the openings from the corridors into the auditorium are hung with heavy peacock-blue curtains on brass rods. The upholstery of the seats is all in deep red plush. The proscenium-arch, the private-boxes, and the portion of the ceiling within the outer line of the boxes, which is flared down towards the rather low proscenium opening, are all finished in woodwork curiously wrought and carved in a semi-Persian spirit; but the designers

did not commit the error of attempting to enrich the immediate surroundings of the stage by obtrusive gilding or pronounced decoration. The tones are rather subdued about the proscenium, and if we are not very much mistaken, the wood is of pine, carefully selected for its color, and varnished to the same gentle salmon hue which pervades the entire interior. The hangings are all a very dark olive in tone.

Above the upper gallery the walls round out into the ceiling with a wide cove, sparingly decorated with a fine, geometrical flower pattern. The ceiling is nearly plain, except towards the centre where



The Dearborn-St. Station, C. L. W. Eidlitz, Architect.

there is a faint diaper of a pale, reddish-brown, fading out into the gray under-tone. The centre is formed with spikey leaf-work in slight relief picked out with dull bronze. There is no chandelier, an innovation which every theatre-goer is ready to applaud. Instead, a quantity of incandescent electric-lights are wrought into the design of the centre, and festooned about the outside on the ceiling, the burners being sunk deeply into the plaster so as to avoid any projection. The effect is very pleasing, and it helps out the decoration amazingly to see these luminous spots shine out from the dark tones as the curtain goes down on the stage. The lower lights are arranged in the same way. Nowhere are there any chandeliers or projecting brackets, but the little balls of fire peep out most happily from amid clumps of the spikey foliage or in the rosettes of the gallery front.

The whole tone of the interior is exceedingly harmonious; possibly a trifle too suggestive of varnished pine about the stage, but that portion is treated so admirably in design, is so thoroughly woodwork in spirit that one cannot help admiring it. Everything is in thorough good taste. The only fault that could possibly be found is, that the drapery about the boxes is rather scanty, as though the designers had feared to interfere with the wooden treatment of the finish. When we add that the heating and ventilating arrangements are no less perfect than the decorations, it will be appreciated what an exceedingly comfortable theatre this is. All of the work, including the decoration, was designed by Adler & Sullivan.

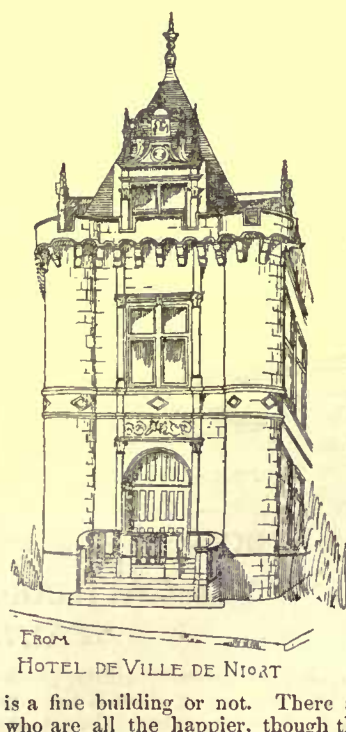
McVickar's is not the only good theatre in Chicago, though it is the best. Cobb & Frost did some very satisfactory work in the Opera-House on Washington Street, opposite the City-Hall, and Hooley's is a very comfortable house, though decorated in a style which ceased to be in favor in Chicago several years ago. It seems so easy to be simple — and simplicity is generally the secret of success in any work of art — and yet it is practically so hard to create a successful theatre, in Chicago no less than elsewhere.

A fact which will probably be the first to impress itself upon a visitor's attention is, that there is but one railway station in the city which is in any way a credit to it, and this, notwithstanding the fact that Chicago is the greatest railroad centre in the country, if not in the world. Sixteen years ago there was a fine, large station at the foot of Lake Street, occupied in common by the Illinois Central and the Michigan Central Railways, and also subsequently by the Baltimore & Ohio. This station was destroyed in the great fire of 1871, and to the shame of Chicago enterprise has never been rebuilt, but serves still to-day, with its fire-eaten, roofless walls and temporary wooden sheds, as a terminus for two of the greatest roads in the land. The Rock Island station was rebuilt after the fire, and enough money was spent on it to secure a good building, but it is badly planned, worse designed and is altogether too small for the traffic it attempts to accommodate. The only station possessing any real architectural merit is the one at the foot of Dearborn Street; a large, picturesque structure, with a prominent central tower which is very well designed in the main, but is capped by an unfortunately conceived roof acting like an extinguisher on it. Had the tower roof been omitted entirely and a simple flat termination added instead, similar to that on the Brattle Square Church in Boston, the design would have gained a great deal in simple, straightforward dignity. As it is, the high, useless roof looks like the work of an amateur, whose flights needed pruning from some steady hand. But in other respects the station is very pleasingly designed, and seems to be very well adapted for its purpose. The color is red — red walls, red roofs, red terra-cotta details, except portions of the lower story, which are of a lighter colored stone. Some day, it is to be hoped, the various roads centring in Chicago will unite to erect a structure which shall be worthy of the immense traffic they represent, and a credit to the city whose rapid growth has called the roads into existence.

The Chicago church buildings have one strong quality. They are well arranged to serve the purpose for which they were built. With a few exceptions the churches were built before the fire, and are, consequently, not remarkable for their artistic qualities, as the real art-growth of the city is still in its first decade; but they were built for congregational worship, and when one goes to church in Chicago there is a pretty sure chance of having a good seat from whence to see and hear to advantage. Conventionalities of planning are, however, as completely ignored as those of style, and there are nearly as many different arrangements as there are creeds; but the plan which seems to have been adopted as giving the most satisfactory result consists of an auditorium, but slightly longer than it is broad, and in a few cases even presenting an exact square. The floor is sloped towards the pulpit, and there is a wide gallery projecting far out into the body of the church on three sides, with a curved front like a theatre gallery, and carried toward the front over the entrance vestibule. There are no transepts, but large rose-windows show where they might be. The choir and organ occupy a niche above and behind the pulpit, and in a few instances the gallery is continued around so as to entirely encircle the auditorium. The gallery is stepped up sharply towards the front, and every seat is made for use. There are no piers to obstruct the view, except the few slender shafts which support the gallery. Such a plan has nothing in common with a Latin basilica or a Gothic cathedral, but it is a practical, sensible solution of a problem which architects generally dodge rather than meet squarely, and it would answer quite as well for the East as for Chicago. A church following essentially the lines just described, is the one on the corner of Warren Street and Ashland Avenue. The First Congregational Church on Washington and May Streets, is another example similarly arranged.

Space would not permit the mention of even a tithe of the many public buildings in Chicago of a purely utilitarian character, such as St. Luke's Hospital, the Sibley Storage Warehouse, one of the best fireproof structures in the country, the Northwestern University, the Jail, etc. In a subsequent paper will be given some notes of the magnificent office-buildings which are such a credit to the architectural genius of the city. C. H. Blackall.

ARCHITECTS AND AMATEURS: FASHION AND TASTE.



From Hotel de Ville de Niort

The study of Architecture with a view to practice is, of necessity, something very different from the study which is devoted to it with very much profit of a different kind by the lover of the art who has no object beyond the pleasure which he derives from contemplating, or, it may be, conversing upon the works of others. But every art is susceptible of becoming more delightful, even for those of the most refined natural taste, in virtue of a certain amount of knowledge as to its past history and associations, and even of a certain degree of technical knowledge. The poet tells us of one for whom —

> A primrose by the river's brim,
> A yellow primrose was to him,
> And it was nothing more —

but he might have insisted that even this would be a good deal. So many a one to whom a fine building is a fine building and there as it might seem is an end, is very far in advance of one who does not care to notice whether it is a fine building or not. There are very busy men in the world who are all the happier, though they do not all know it, as thankfully as Charles Lamb, for a passing glance every day at St. Paul's Cathedral. The general impression which it produces is, after all, the most important, and of this they are participants; still more distinctly so are they who come to it in a series of surveys of the sights of the metropolis, — but still more, such whose appreciation of the style has been exercised by attention to other monuments of Renaissance Architecture, and are at home among the memories of the times, and the men who moulded and remodelled it.

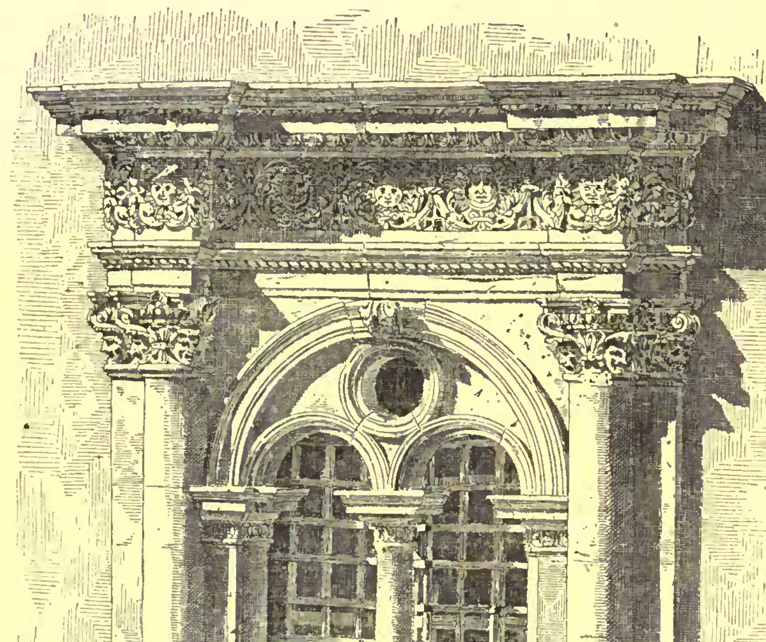
Such a one is sometimes called an amateur; but this word has been

arbitrarily seized upon as convenient title for one who is not professional, but claims, with more or less justice, to have the acquirements which justify his dispensing with professional assistance, and even to put himself in rivalry with the specially educated and trained. We are more familiar with the status and works of amateurs in painting than in architecture; but amateur architects snatch at their opportunities, if only in housing themselves, with better or worse success. Such amateurs, truly, are but in scanty repute, and the more is the pity that they should have engrossed a title which leaves the amateur proper — the disinterested lover of the arts — to fall back upon that of "*dilettante*," which, with equal unfairness to its original meaning and employment, has gathered in use a certain taint of disparagement.

If the amateur in the extreme sense is what he pretends to be, he ought to be an architect, — but the architectural *dilettante* is under no obligation to assert himself in the same sense as such an amateur. He delights in architecture and, it may be, can give very good account of what it is that he finds in it delightful, — can discriminate with taste and judgment between what is justly admirable and what is not; between permanent and transient effect; between the grace which will establish itself for all time and the fashion that may have a long day, but will, at last, be only for its day.

It is, perhaps, in respect of fashion that the proper *dilettante* is liable to be most mistaken in one direction, as the amateur in the other. The amateur usually unfurls all his sails to the fashionable breeze. He is a very representative of the class by whose whims and fancies fashion is affected from day to day; whereas the *dilettante* often lives too much in the past, and transfers his interest too frequently from one past age to another to fall easily under the tyranny of a contemporary gust of caprice, but also too exclusively to be fair to contemporary genius and merit. As regards the architect proper, he cannot be, and it is right that he should not be, independent of considerations of fashion. It is right on more than one account. In the first place, if he will persist in designing in a style which none of the society that constitutes his environment can away with, his work will never leave his portfolio, — he will have nothing to do. The error in the counter extreme is to be the obsequious slave of fashion; to be nervously intent on catching the latest and faintest hint of the direction in which public anxiety for novelty is drifting; nothing can more fatally sap that artistic self-respect which is the very germ of energetic originality, and where originality fails, art has come to an end.

But originality implies novelty, and so far is in sympathy with fashion, for the very life of fashion is constant succession of stimulating novelty within a range which has certain definite restrictions. Fashion as unquestionably a power must, like every other power, be taken account of by the practical; it is entitled to be treated as an independent entity which has certain natural characteristics that are developed in all matters whatever that appeal to the emotions, especially the æsthetic emotions, which are matters of taste. Fashion asserts itself, whether in schools of music or poetry or styles of architecture with definite regard to general laws which are ultimately the very same that govern the transitions of feminine dress. No announcement is more frequently thrust before our eyes in the very capital and precincts where such fashion reigns absolute, than *Nouveautés!* There is instruction in noticing what relation the free variable bears to the permanent in these august domains. Who does not see that the inventive genius of the *modiste* is exercised on working out all the available varieties of an imposed type. "*Est modus in rebus*" might be as philosophically as punningly the motto of the *modiste;* there is a law in control of gradation fixed for the time, which cannot be disregarded. A bonnet-shop in the Burlington Arcade might, if not teach a lesson in the laws of evolution, supply an illustration of them to Mr. Herbert Spencer or Dr. Huxley. Here they might compare a sequence of development without one missing link, in comparison with which the boasted pedigree of the horse from the four-toed hipparion is an assemblage of loose and mismatched links. Let them allow an interval to pass and then renew their studies on the same ground; they will have to admit possibilities of a transition nothing less than cataclysmal. What has become of the lately dominant type? Vanished! and yet a law exists, and may be traceable, which underlies the change. Taste, like appetite, becomes cloyed and jaded at last by a course of even the most artful variations, or finally rebels when, novel variations being all exhausted, an attempt is made to revive some of those which have not so very long been superseded. Some more positive variation, some more absolute contrast becomes demanded; the novelty is still in this case dependent on what went before, but no longer by general resemblance, but by specific difference. Let not such analogies be scorned; they are much to the point. Have we not here the antitype of all development, — of architectural development? How simple was the type of the Greek temple! how it was varied in every instance by new schemes and modifications of proportion! How it was adhered to fundamentally, even through transitions from Doric to Ionic, and to Corinthian. Each change brought a stimulant effect of novelty. When perfection had been reached, still new attempts were made at ringing new changes, till new needs combined with satiety to break through the limits of habitual forms, and prepare the conditions of a new career of development.



WINDOW IN THE CLOCK-TOWER OF THE CATHEDRAL, MURCIA, SPAIN.

Such transitions are well worthy of especial study; for every architect stands more or less positively at the crisis of such a change, and always has stood. But at the present time his position is peculiar. The world has lasted a long time. The surface of the earth is beset with structures of a vast variety of styles, — well preserved or well restored, in fact, or in books. The essential elements of construction are not infinite; they may, perhaps, be said to have all had their turn; it seems as little hopeful to expect that a positively new style can originate as that we shall witness the appearance in the

world of a positively new species of mammal. What a marvellous sequence of developments are before us in a series of Gothic windows or Gothic mouldings. Who will be bold enough to hope to produce still an addition to them which shall not be a mere imitation, or else have the worse appearance of a good thing spoiled. Are, then, all the best and most prolific ideas already appropriated and exhausted? Such complaints have been uttered. Goethe once entertained a project of founding a poem on the adventures of a civilized man among barbarians and islanders; he avowed that he renounced it because he found that the possibilities of all the happiest combinations of such a subject had already been recognized and made the very best use of by Homer in the Odyssey. Yet it seems pusillanimous to admit that any art can be absolutely effete. One mode of escape from the difficulty is sometimes adopted, but cannot be commended either for its principle or its success; this is to try the effect of simple reversal of all previous accepted practice. Has it become the rule for pillars to diminish upwards, let them be turned upside down, and so diminish downwards; have cornices and mouldings been relied on as decoration, suppress them entirely; make the breadth of windows systematically exceed their height, etc. So we have schools of critics, who, finding that nothing more can be said in exaltation of the merits of the greatest Italian artists, set to work to dethrone them and elevate the second-rate — the men of the immature dawn or the advancing decadence — to the forcibly vacated pedestals. There is as much opportunity for paradox and oddity in architecture as the world is familiar with in sophisticated representations of historical events and historical characters. There are more worthy ways by which a student may test what resources for novelty an art still possesses, and what resources of originality his own capacity or genius may display. His field of study comprises the past and the present, — the past, which is to be studied with the present never long absent from his mind, and the present never long divorced from thoughtful comparison of the remotely as well as of the immediately passed. That the great masterworks of his predecessors should attract him is to be expected — is to be commended; too much thought cannot be given to evolving the principles on which their excellence and beauty depend. But when this analysis has been most successful, the result, if duly interpreted, will be a warning that much of the success was relative to a particular epoch, and that crude reproduction or mere imitation would be a mistake.

Strange as it may sound and seem, an even more productive direction of study will be to the failures of past ages and immediate predecessors. Some of the most positive of such failures are failures in great attempts, imperfect realizations of good ideas, strivings after effects of which glimpses have been perceived, but have never been thoroughly thought out, accidental hints which have been too carelessly dropped, and then left alone from sheer inability of those to whom they occurred to estimate their true value. It is in this manner that Nature seems to suggest new motives spontaneously, as the gardener, from time to time, is favored with what he calls a "sport" which will repay most careful cultivation. It may be well to forego, for a time, indulgence in admiring perfect beauty, to devote attention to even an exceedingly faulty design. This may be a wild stock well worthy of grafting. When all that is wrong and all that is false is eliminated, there may yet be some soul of goodness, and the exercise for the student will be most advantageous of revising the whole, and turning a bad design into a good one, — a good one, of which the excellence will be due to giving fair play and full development to a native suggestion, which before was all but overwhelmed by inconsistent and uncongenial environment.

No more is proposed here for the architectural student than what the greatest geniuses have ever been prompt to prosecute in other arts. Among the poets, the greatest of all — a Shakespeare and a Milton — are found under what are called, and are indeed, no inconsiderable obligations to poems, plays, novelettes, which are replete with suggestive hints and materials that their authors had made something, but were far, indeed, from making the best of. The musician retains in an elaborate composition the traces of musical ideas which were not taken full advantage of by their original authors, or were floating loose in traditional popular melodies.

It may be frankly said that after study has been liberally given to all that is excellent and to much that is imperfect and defective in the works of past and more recently past times; still, the most productive hunting-ground for important suggestions will probably be among contemporary failures or half successes. Here it is that the pressure of present requirements will, from time to time, break down the most obstinate conventions, but sometimes only timidly and sometimes awkwardly. Here it is that are to be met with the first attempts to solve the new problems which are presented by the application of new materials and new modes of decoration, new possibilities of construction. Even extravagant vagaries of fashion may be found not to be without their use; they serve, at least, as announcements in the world of novel combinations, and sometimes prepare for the welcome reception of the same elements when reduced by stricter taste to harmony and repose.

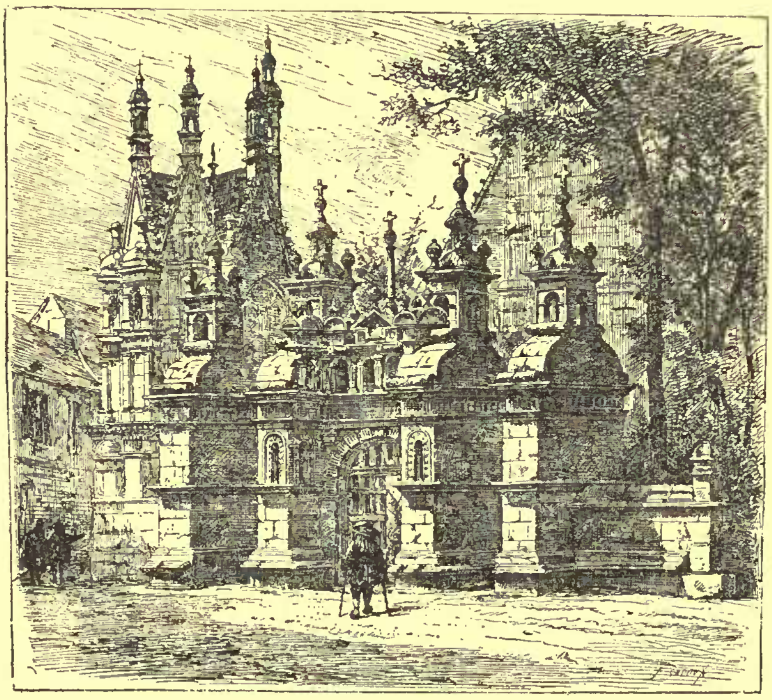
W. Watkiss Lloyd.

The Illustrations

[*Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.*]

DRILL-SHED, QUEBEC, CANADA. MR. J. B. DEROME AND MR. E. E. TACHÉ, ARCHITECTS, QUEBEC, CANADA.

[Helio-chrome, issued only with Imperial Edition.]



CEMETERY ENTRANCE, ST THEOGENNEC, FRANCE.
From "Le Moniteur Des Architectes"

FIREPLACE IN HOUSE BUILT FOR HENRY VILLARD, ESQ., NEW YORK, N. Y. MESSRS. MCKIM, MEAD & WHITE, ARCHITECTS, NEW YORK, N. Y.

[Gelatine Print.]

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SKETCHES AT NORTH WOBURN, MASS., AND ELSEWHERE, ASSOCIATED WITH COUNT RUMFORD.

See article on "Count Rumford" elsewhere in this issue.

DESIGN FOR SUMMER COTTAGE. MR. GEORGE K. THOMPSON, ARCHITECT, NEW YORK, N. Y.

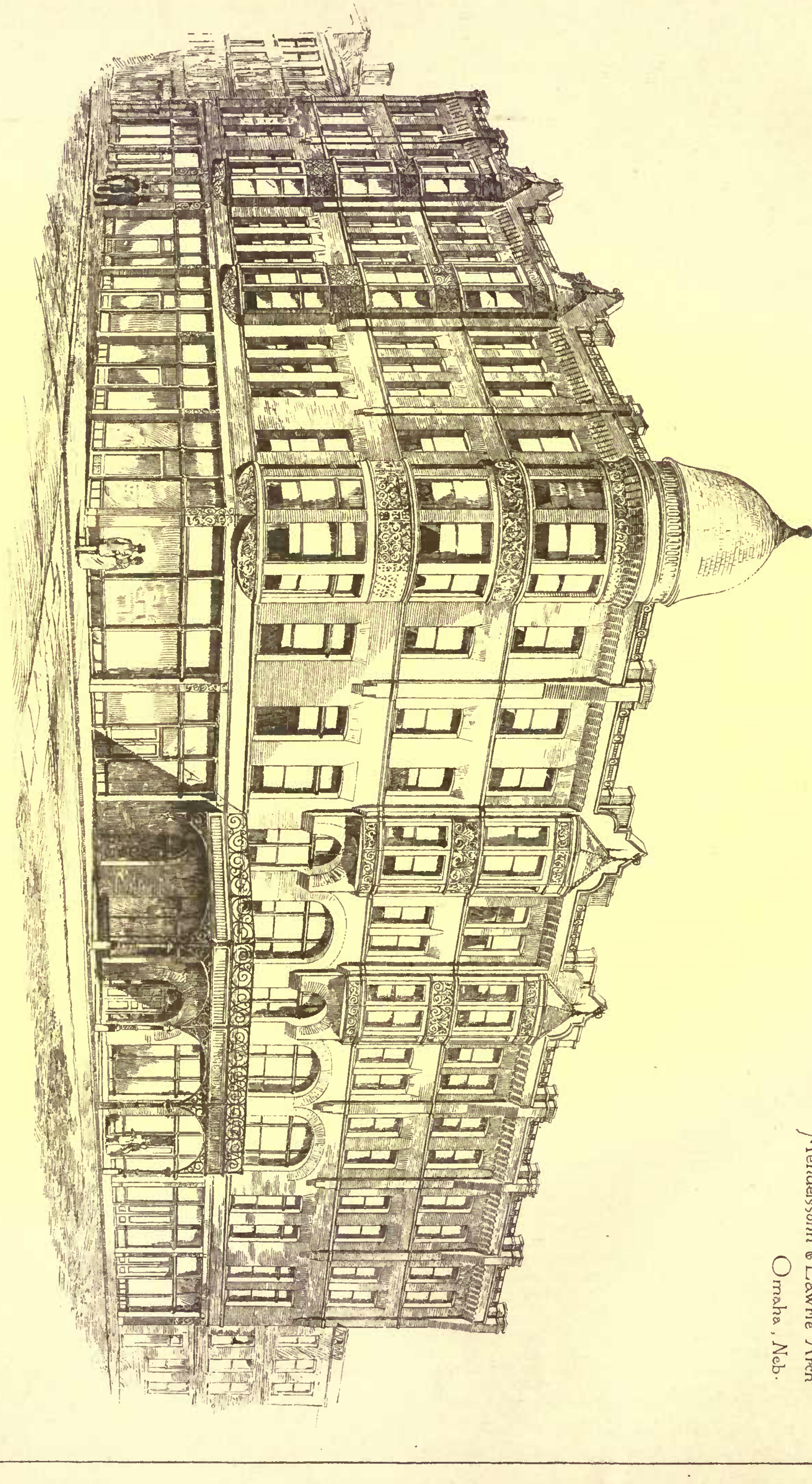
THEATRE AND HOTEL, BEATRICE, NEB. MESSRS. MENDELSSOHN & LAWRIE, ARCHITECTS, OMAHA, NEB.

THE CATHEDRAL OF LAUSANNE, AFTER AN ETCHING BY ALEXIS FOREL.

The Protestant cathedral of Lausanne was built in 1235–1275, and consecrated by Pope Gregory X. It is a Gothic structure, plain but massive, and stands on a terrace reached by one hundred and sixty-four steps from the market-place. Its interior, three hundred and fifty-two feet long by one hundred and fifty feet wide, is noted for its symmetrical proportions. The vaulting of the nave, sixty-six feet high, is supported by twenty clustered columns, each one of different design. Other details worthy of mention are the semi-circular colonnade in the choir, the beautiful rose-window, and the west and south portals, with their carving. There are also some interesting monuments, the finest of which is that to Duke Victor Amadeus, of Savoy, who died in 1451. In this church in 1536, Calvin took part in a celebrated debate, which resulted in the Protestantizing of the Canton of Vaud. From the terrace a magnificent view of Lausanne, with Lake Leman and the Savoy Alps is offered.

M. Forel, who first became known as a painter, was born in the lovely village of Morges near Lausanne, and studied in Paris under Lefebre and Boulanger. He has etched "The Apse of Nôtre Dame" and a number of landscape subjects. Most of his plates are large in size, and all have much merit. Among the best is the one we reproduce showing the picturesque spires of the cathedral outlined against a gorgeous sunset sky with the tiled roofs of the town lying below.

We are indebted to Messrs. F. Keppel & Co., of New York, for permission to copy this print.

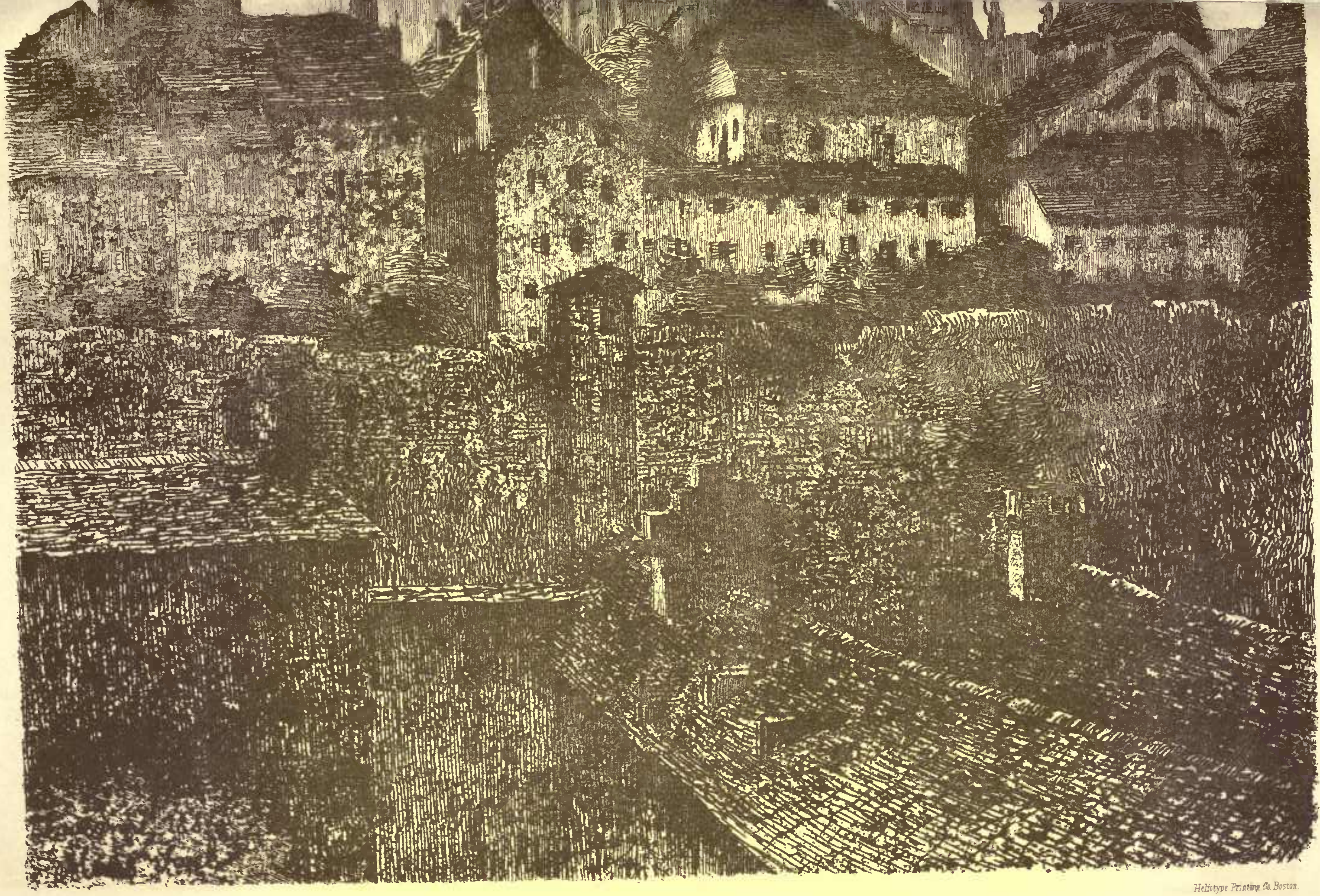


THEATRE & HOTEL at BEATRICE, NEB.
for the Hon: A. S. PADDOCK
Mendelssohn & Lawrie Arch^ts
Omaha, Neb.

Heliotype Printing Co. Boston.

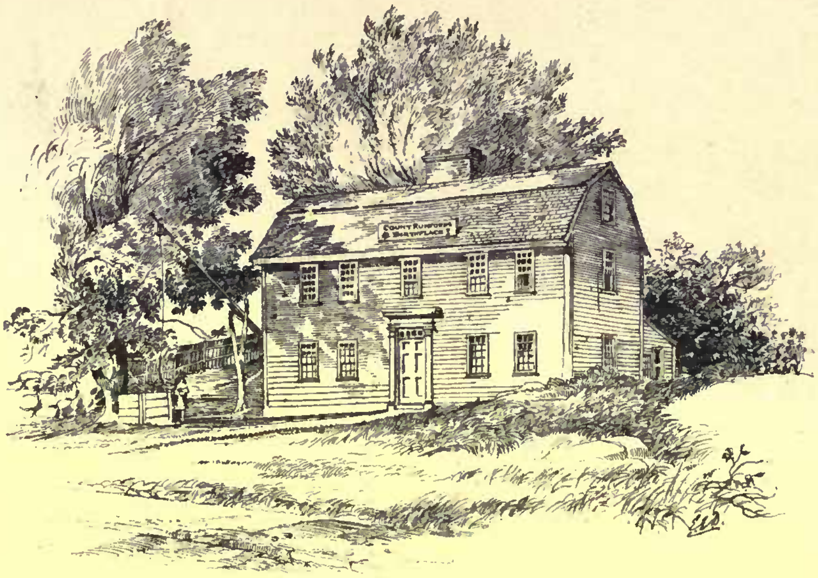
American Architect and Building News, Dec. 24 1887.





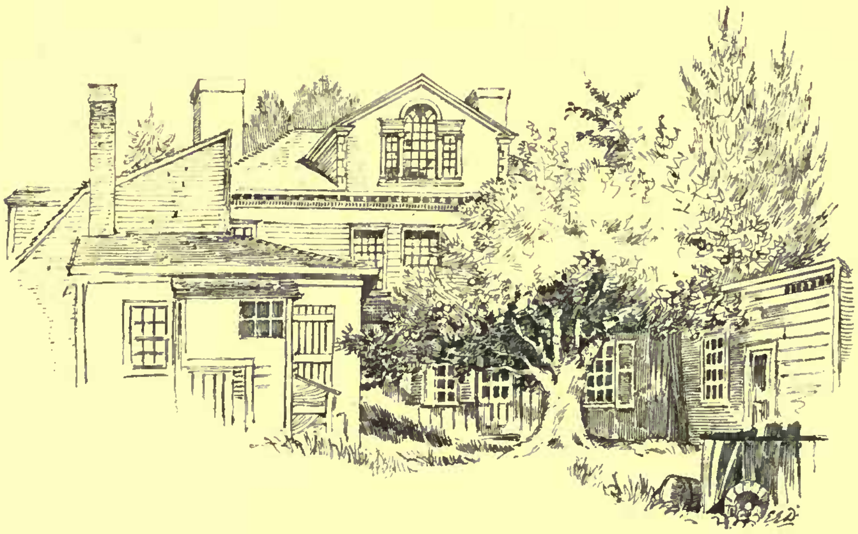
Heliotype Printing Co. Boston.

Lausanne Cathedral
after an Etching by Alexis Forel.



House in which Benj^n Thompson (afterwards "Count Rumford") was born.





House (traditionally) built for Count Rumford's return from Europe, locally known as the Wheeler House. Rear view.



Part of same house.



Chamber in the Rumford House, with the Count's "cradle"

Sketches

and elsewhere.



Old Corner House o



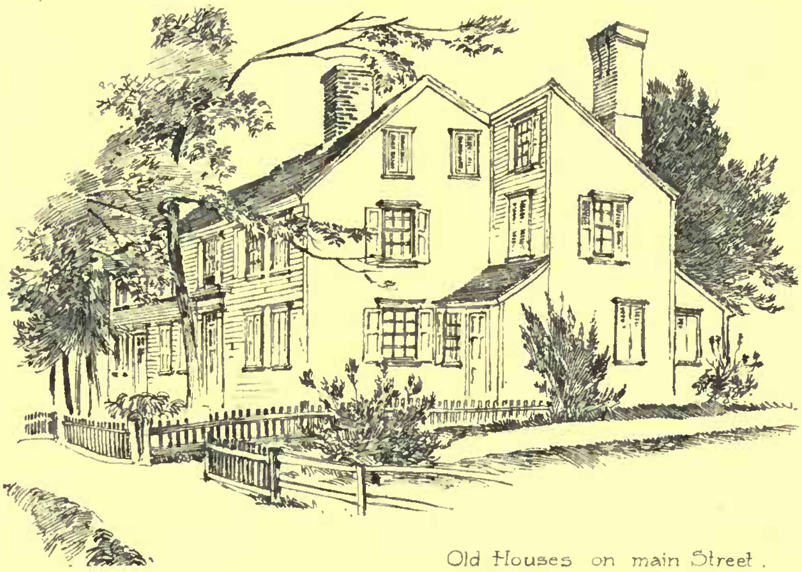
...Wheeler House



House built by Rev. Tim. Walker. 1734. Concord. N.H. in which Bejn. Thompson was married & resided: bequeathed by his daughter the Countess, with an endowment for hospital purposes.



Statue of Count Rumford in Munich Bavaria.



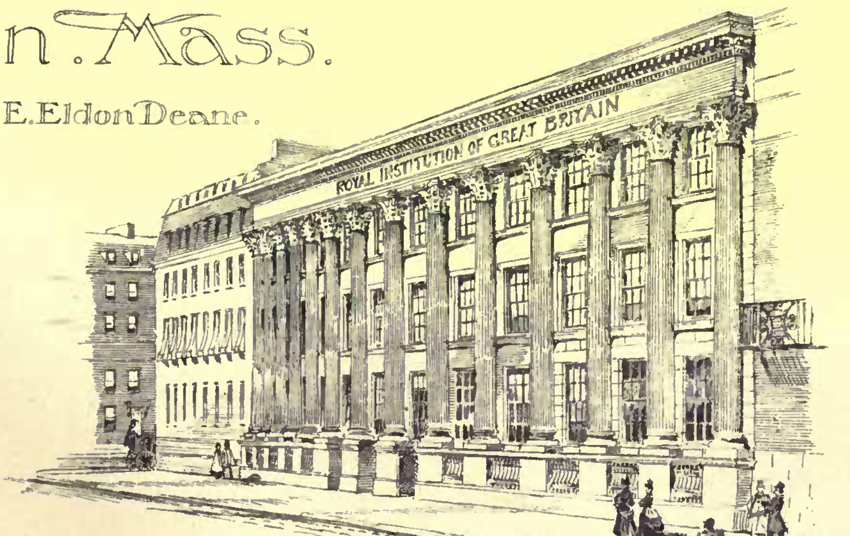
Old Houses on main Street.

...orth-Woburn. Mass.

by E. Eldon Deane.

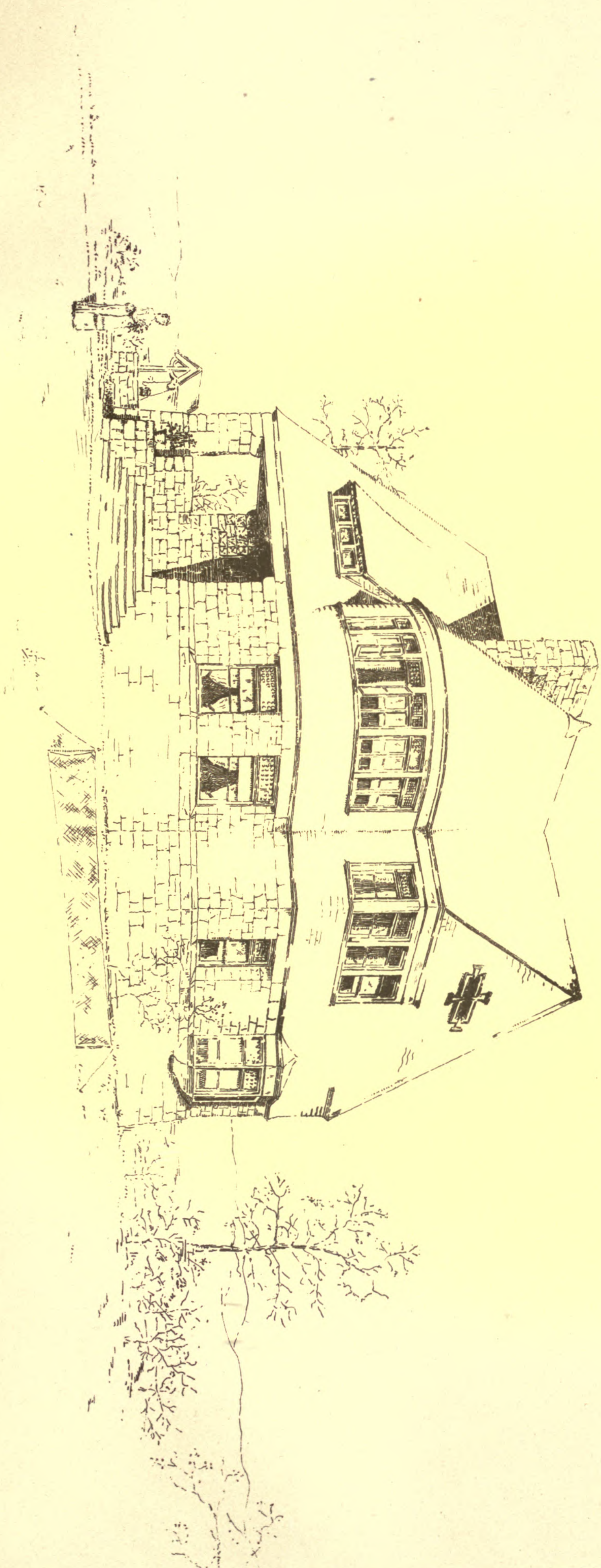


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Royal Institution. London Engd. founded by Count Rumford

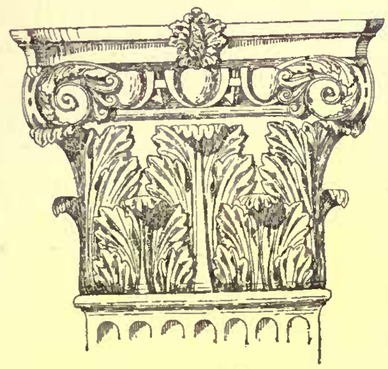
Heliotype Printing Co. Boston.



NOTE. — We are glad to be able to identify the "View in Normandy," published in the "*American Architect*" for July 23, 1887.

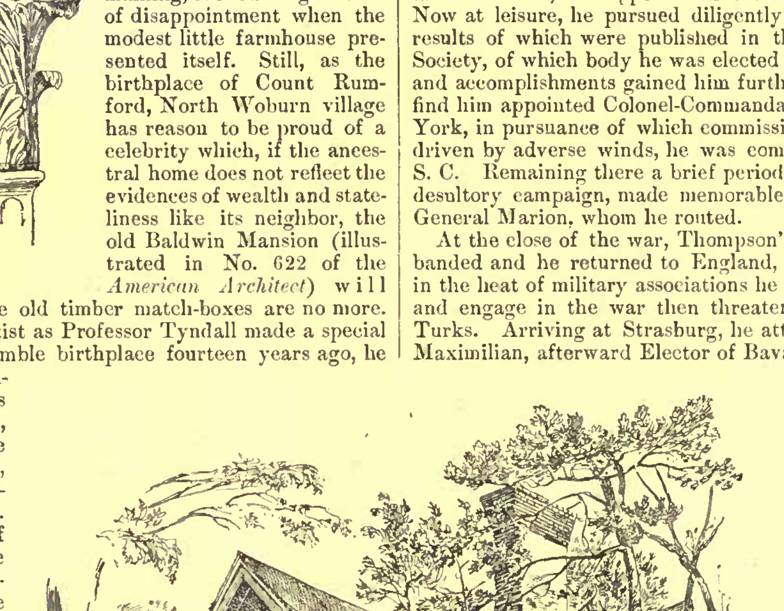
This fragment of a feudal manor of the 16th century stands on the sloping bank of the Oebec in the little village of Beuvillers, near Lisieux. It was doubtless the keep of the old fortified house and the little river (or, more properly, brook, for it is hardly worthy of the larger name) served as its moat. One of the two turrets which flank the postern contains a staircase leading to a high chamber, the floor of which is beautifully paved with terra-cotta squares arranged so as to form a rose-pattern.

COUNT RUMFORD.



CAPITAL — FRENCH
— XVI CENTURY —

A CASUAL direction to go and sketch the old Rumford House at North Woburn, Mass, with the old well-sweep still remaining, evoked a slight sense of disappointment when the modest little farmhouse presented itself. Still, as the birthplace of Count Rumford, North Woburn village has reason to be proud of a celebrity which, if the ancestral home does not reflect the evidences of wealth and stateliness like its neighbor, the old Baldwin Mansion (illustrated in No. 622 of the *American Architect*) will grace its memorials when the old timber match-boxes are no more. When such an eminent scientist as Professor Tyndall made a special visit to Count Rumford's humble birthplace fourteen years ago, he paid a compliment to the memory of an illustrious man, as gratifying as it was deserved, and one than whom, in the commencement of this century, few, if any, of his contemporaries were more widely known. The following brief outlines of his almost romantic career are derived from "*Ellis's Biography*" and an admirable epitome of the same in a lecture by the Rev. W. S. Barnes, given in the Lyceum course at Woburn in the winter of 1872–73.



Benjamin Thompson, afterwards Count Rumford, descendant in the fifth generation from James Thompson, one of the earliest settlers of Charlestown village, now North Woburn, was born March 26, 1753. During his boyhood his peculiar mental qualities developed themselves in unremitting experiment and research. Apprenticed to a merchant, instead of looking out for customers over the counter, he was busy with tools and instruments under it. His thirst for knowledge at this time was inextinguishable, mathematics, mechanics and natural philosophy being his hobbies. After a study of medicine under Dr. Hay, of Woburn, which afforded him also the opportunity of attending scientific lectures at Harvard, we find him teaching, with this testimony, that he was himself his most zealous pupil. Offered a permanent position in this capacity in Rumford, now Concord, N. H., (so called on the amicable settlement of a dispute as to which Province the jurisdiction of the town belonged to), he accepted the same and here formed the acquaintance of Mrs. Rolfe, daughter of Mr. Walker, whom, notwithstanding the disparity of their ages, he married, thus securing considerable property and social status. Through his wife he became known to and a friend of Governor Wentworth of New Hampshire, from whom he subsequently received a major's commission in the 2d Provincial Regiment of New Hampshire. This unfortunate kindness secured the ill-will of less fortunate and subordinate officers, whose prospects were injured thereby. It is not for us here to relieve Thompson's memory from an unjust imputation of Toryism, but to the fact just stated may be traced much of the hostility which afterwards drove Thompson into exile. To be the friend of Governor Wentworth in the excitement and fever of the Revolution was sufficient to provoke the distrust of the Sons of Liberty, and though twice formally and fully acquitted before a committee of patriots of the charge of being unfriendly to the cause of Liberty (by the way, where was the liberty here?), Thompson found it impossible to find respite or safety except in foreign lands and among strangers. To his orderly mind mob rule and rebellion were detestable and hateful, and so October 7, 1775, he left Woburn never to return. There is a tradition that Thompson assisted at the Battle of Bunker Hill, and certain it is that he showed his gratitude to Harvard at this time by his friendly aid, when the conversion of the College buildings into barracks made it necessary to pack and store its library.

As before stated, Thompson left Woburn, and, driven to Narragansett Bay, was taken on board the British frigate "*Scarborough*" and conveyed thence to Boston within the British lines. After the evacuation he was sent to England with the news. Here he was received with considerable favor by Lord Germaine, one of the Secretaries of State, and appointed Secretary of the Province of Georgia. Now at leisure, he pursued diligently his scientific experiments, the results of which were published in the *Transactions* of the Royal Society, of which body he was elected a Fellow. His native courtesy and accomplishments gained him further distinctions at court and we find him appointed Colonel-Commandant of Horse Dragoons at New York, in pursuance of which commission he sailed for that port, but driven by adverse winds, he was compelled to put into Charleston, S. C. Remaining there a brief period, Colonel Thompson pursued a desultory campaign, made memorable only by an engagement with General Marion, whom he routed.

At the close of the war, Thompson's New York regiment was disbanded and he returned to England, soon again to leave, for while in the heat of military associations he decided to go to the Continent and engage in the war then threatening between Austria and the Turks. Arriving at Strasburg, he attracted the attention of Prince Maximilian, afterward Elector of Bavaria, who, pleased with Thompson's intelligent descriptions of the war and his agreeable manner and address, gave him a friendly letter to his uncle, then Elector of Bavaria. By the latter he was received most cordially, and the threatened war being abandoned, after his return from Vienna, Thompson was induced to enter the service of the Elector, receiving, with King George's permission, the honor of knighthood. Indeed, now Thompson's lines had fallen in pleasant places. Honor were rained upon him. On request of the Elector, he was made by the King of Poland, Knight of the Order of St. Stanislaus, commissioned Major-General of Cavalry, appointed Privy Counsellor of State and Head of the War Department. In 1791, he was invested with the rank of a Count of the Holy Roman Empire, an honor which he credited by choosing as his title the name of the New Hampshire town where he spent the opening years of his manhood.

Count Rumford's versatile gifts and experience seem to have warranted his subsequent trusts and responsible powers. Furnished with a palatial residence, a corps of servants and a military staff, he devoted himself at once to the solution and amelioration of the social and diplomatic relations of the Electorate — afterwards grappling with gigantic social evils which made Bavaria notorious. In succession, the demoralized military establishment of the country demanded his attention, and with the Elector's permission he was able to introduce a new system of order, discipline and economy. Finally, the philanthropic removal of mendicancy — a pest in the country — engaged his efforts, and so successfully, that the poor of Munich, during an illness, went in procession to the Cathedral to offer public prayers for his recovery, so grateful were they for the philanthropic and systematic means he had established for their help and maintenance. Equally laborious, too, during these years were Count Rumford's scientific efforts — covering a wide range of experiments chiefly investigating the nature and properties of light and heat.

It is assumed that preëminently to him belongs the honor of exploding the old and materialistic theory of heat, and discovering the

new doctrine thereof, the law of the correlation and equivalence of physical forces — as an instance, heat may be converted into motion and *vice versa*. No force is ever lost — arrested motion is not lost energy, the suspended force distributes itself among the particles of the arrested bodies, and appears in the form of heat. Newton and his law of gravitation had scarcely more influence upon the current theories of physics than Count Rumford and his discoveries of the mutual convertibility of the forces of Nature upon the philosophy of to-day.

In 1795, after a residence of eleven years in Munich, Thompson revisited Great Britain, securing public attention to the measures he had been so successfully carrying out in Germany, some of which he attempted in Edinburgh, Dublin and London. One of Count Rumford's favorite institutions was the public kitchen, and he wrote to his daughter that upwards of 60,000 persons fed daily from the different public kitchens in London alone. At this time he gave the sum of $5,000 to the American Academy of Sciences at Boston, for the purpose of supplying a Rumford medal "as an incentive to investigations" in light and heat — the preference being given to such discoveries as shall tend most to *promote the good of mankind* — for a similar purpose he gave a fund to the Royal Society in London; its first medal being awarded to himself.

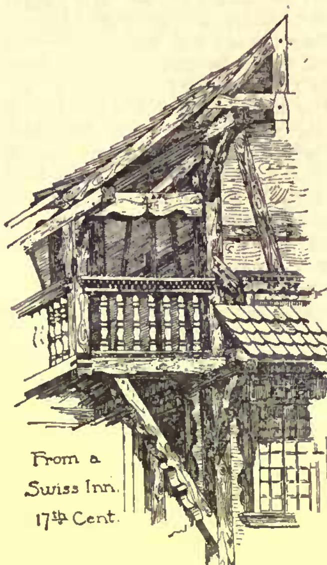
The Count's visit to Great Britain was cut short by serious intelligence from Bavaria. The Elector who had endeavored to hold himself neutral in a war then transpiring between Austria and the French Republic, suddenly found his territory invaded. An Austrian army defeated by the French, retired on Munich, followed by their victors, who likewise took position commanding the city. The Elector fled, leaving Rumford, who had hastened there, with his appointment, head of the Council of Regency, with absolute powers. Assuming chief command, Count Rumford shut the gates of the city, and by his wise, firm and prudent management, induced both armies to retire. It was a magnificent service which the Elector and his people gratefully appreciated and rewarded.

Determining soon after to revisit England, the Elector to show his esteem appointed him Minister Plenipotentiary and Envoy Extraordinary to the Court of St. James. That a British-born subject should assume such a mission was by the Government considered inadmissable — a slight which Count Rumford considered aimed at himself, and felt acutely — nevertheless, he busied himself once more and this time in developing the scheme for a Royal Institution for diffusing the knowledge and facilitating the general introduction of useful mechanical inventions and improvements, and for teaching by courses of philosophical lectures and experiments, the application of science to the common purposes of life. This noble Institution, dating from 1799, has fulfilled its worthy purposes. In its laboratory many important discoveries have been made; among its lecturers may such scientists as the following be numbered: Humphrey Davy, whom Count Rumford brought to notice, Michael Faraday, Professor Tyndall. A more promiscuous list includes Sydney Smith, Coleridge Campbell, Landseer, Opie, Flaxman, Sir Geo. Lubbock, Max Muller and Seymour Hadyn. In 1803 the Count left England for the last time for the Continent, where, after his second marriage, not a happy one, he died in Paris at the age of 61.

Rumford was a scientific philanthropist, consecrating his scientific culture to the well-being of the community. Munich, the capital which he enriched, has commemorated him by a monument in the English Gardens, and by a bronze statue in its principal street; Paris, which contains his grave, had a street named after him; London commemorates him in its still vigorous Royal Institution and Medal. In America, his name is perpetuated in a professorship at Harvard; by the medal fund in the Boston Academy of Sciences and Arts, and the buildings of the City Charities on Chardon Street. But his birthplace, Woburn! Here beyond the sign on the house, there is little to proclaim the honor of this good and illustrious man.

IS CLAY A MINERAL? — Simple as the question may seem, the existence of the water-supply of Glasgow is depending upon it, unless, indeed, the public rights in the preservation of the supply are recognized, apart from the liability of the authorities of the city for the payment of compensation. In purchasing land for reservoirs and conduits at Westhorn, near Glasgow, the sum paid being £11,000, there was a reservation of "the whole coal and other minerals." The clay is valuable, and the present representative of the vendor has worked it on his ground almost up to the boundary of the part belonging to the Corporation. He claims the right of extending his workings, regardless of the destruction of the reservoir and buildings, unless he receives £10,000 compensation, his contention being that the clay forms part of the "other minerals" wh ch were excluded from the property transferred to the Corporation. There is no precedent to establish whether or not clay is a mineral in the lawyer's sense, and the case has given rise to opposing decisions in the Scottish courts. It is now before the House of Lords for determination. The Corporation maintain, in the first place, that the character of the ground was well-known at the time of the sale, and was, indeed, one of the causes which led to the purchase of so much land at Westhorn, while, in the second place, it would be contrary to usage if clay were considered as a mineral, although it may be so in a scientific sense. It is admitted that by the Railway Clauses Act clay may also be taken as a mineral, but there is no judgment of the House of Lords upon that interpretation. The argument on the other side is that clay is to be acceptable as a mineral, because it is possible to work it at a profit. In the Scottish courts there was a majority of judges against the Corporation theory, but it remains to be seen whether the House of Lords will take the same view. — *The Architect.*

RECENT DISCOVERIES AT ROME.



THE great upheaval in modern Rome, caused by the extensive public improvements, the laying out of new streets, and the regulation of the Tiber, has brought with it many archæological discoveries of deep interest, adding to our knowledge of the ancient time, and revealing fresh treasures to awaken our admiration, already bewildered by the glories of the Eternal City. Not the least among these art-treasures is the house discovered in the garden of the Villa Farnesina, otherwise so widely known for its frescos from the hand of Raphael. By the almost miraculous preservation of Pompeii and Herculaneum, the modern world has been brought face to face, as it were, with the life of the ancients. In these cities do we especially obtain a vivid impression of the extent to which art adorned the common walks of the people. The gayly-frescoed walls and marble courts give us a picture of the charms which pervaded the homes of the citizens, penetrating even the humble abodes of the poor. The frescos on the Palatine Hill, long since brought to light, had shown to some extent that the same taste in adorning private dwellings existed in Rome itself, but the recent discovery of this ancient house in the Farnesina garden furnishes still clearer witness to the fact. But while the frescos in Pompeii, beautiful though they be, are evidently the work of provincial artists, this Roman house bears witness to the exercise of talents and skill of a higher order, as might be expected in the great capital.

The German Archæological Society at Rome has earned the well-merited thanks of all lovers of antiquity, and that in one of its most attractive aspects, by publishing in the large and well-executed plates of their "*Monumenti*," accurate and exhaustive reproductions of the frescos which still adorn the walls of this ancient villa.[1] A word-description seems barren indeed when compared with these eloquent sheets. Here a wealth of harmoniously-blended color is seen throwing its exquisite veil over plaster and stucco. Chaste ornamentation, such as inspired Raphael and the other workers of the Renaissance, winds its fascinating tracery over the whole. We see on these walls borders, friezes, columns, masks, caryatids, and the architectural illusions of temple columns and open doors combined in graceful symmetry, while the panelling is reserved for choice mural paintings, which would suggest themes without number for the artist of ideal or allegorical subjects.

These paintings, which are conceived as held in a grand architectural frame, are of most varied themes. One of the largest represents the infant Dionysius in the nursing care of the nymphs. Another gem, representing Aphrodite, her attendant, perhaps Peitho, and Eros, is probably a copy of some celebrated ancient painting, in which the artist reproduced in Aphrodite's figure the type of ancient idols as seen in old terra-cottas, a method familiar also from the paintings of Pompeii. The beautiful goddess is adorned with her *polos* (castellated crown), and holds the lily in her hand as she sits on her throne while she is being veiled by her attendant behind her. Winged Eros stands before her as if awaiting her commands. Nothing in the whole range of Pompeiian wall-painting can awaken the admiration produced by this work, in which the old representation of the goddess with archaic crown has been transformed by the artist in the spirit of the new life of his time, probably the fourth century B. C. Other paintings, scenes connected with worship, the stage, the court, and daily life go to adorn the walls of the Farnesina house.

The removal of the buildings and accumulation of ages on the Esquiline and Viminal Hills at Rome has reached the archæological strata below the historic city, touching the primitive level of the soil. Upon this was built the oldest Roman wall, that of Servius Tullius, with its *agger*, which had to be removed to make way for modern buildings. The remains of primitive habitations were to be recognized, and, by far more manifestly, a vast necropolis, the sepulchres of which appear in groups at intervals all over the extensive area of the city comprised by the streets Merulana, St. Martino, Dello Statuto, the Piazza Victorio Emmanuele, and the Villa Spithover, the same zone through which extends the Servian wall.

In none of these ancient tombs, according to Pigorini, have been found traces of cremation. The mode of sepulture gives evidence of extreme antiquity. Of the greatest significance for archæology is the fact that in each tomb was found an earthern cup, characteristic of the prehistoric lake-dwellings and the age of bronze existing in the valley of the Po, therefore older than the cemetery of the Via Dello Statuto, which belongs to the first age of iron. This strengthens

[1] "*Annali dell' Instituto di Correspondenza Arch.*," Vol. LXVII. "*Monumenti*," Vol. XII. A. Ascher & Co., Berlin. "*Bulletino dell' Instituto di Correspondenza Archeolog.*" 1885. A. Ascher & Co., Berlin.

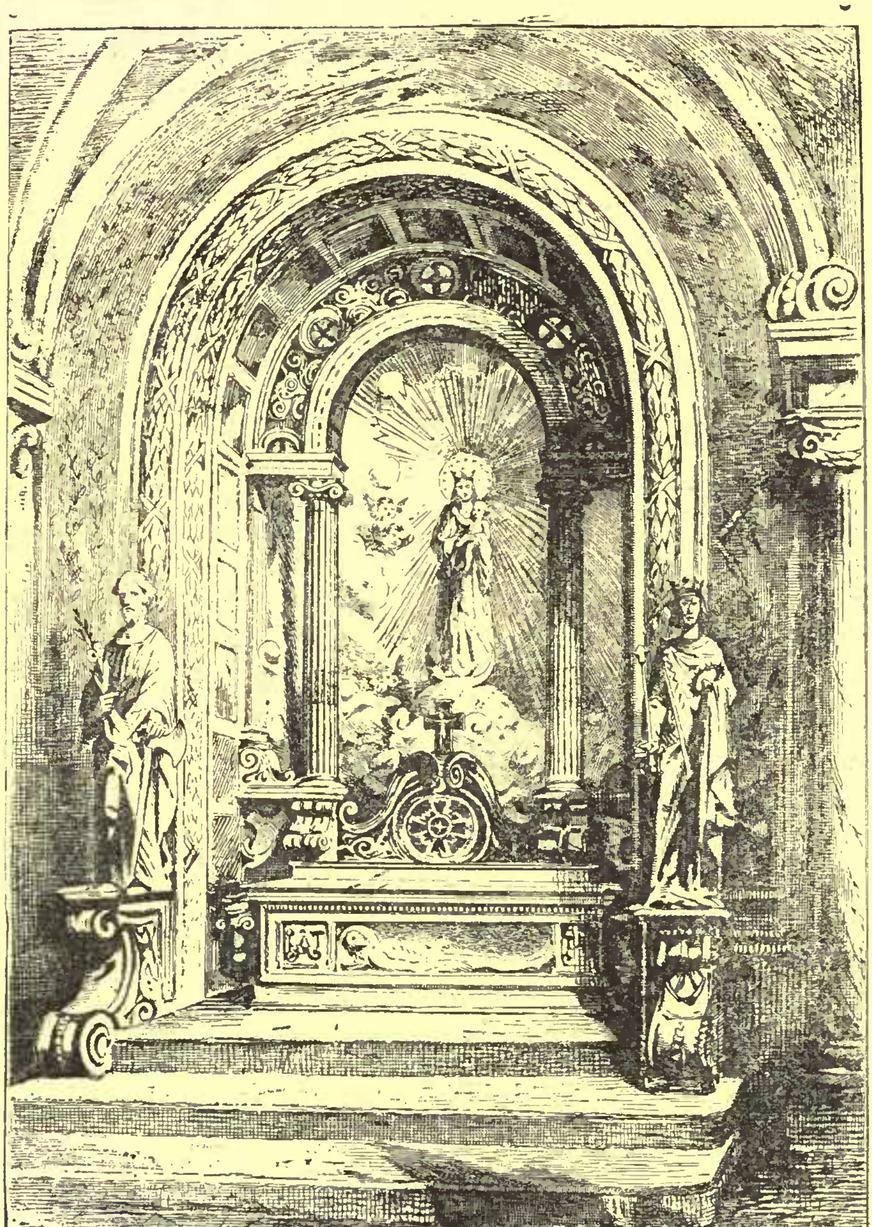
the opinion of those who seek to find the origin of the early inhabitants of Latium in the people known under the generic name of lake dwellers. Confronted with these races, the hoary names of Romulus and Remus, with their wolf nurse, become almost our contemporaries and ancient Rome seems a modern city.

On breaking up the Servian wall at a point where it was intact in its whole height and without any signs of having been disturbed, there were found three tombs to which De Rossi draws special attention. In one of these was found a sarcophagus of a kind hitherto unknown. It is a cylinder of terra-cotta divided into halves, the lower of which contained the skeleton, the upper serving as a lid. Both parts were furnished with knoblike handles, five on a side, which evidently served to carry the sarcophagus as a bier and to raise the cover. The crude art, the hand-made work without mould and the character of the objects found within it, show the primitiveness of this production. In no other instance has the priority in age of the ancient Roman tombs to the most ancient mural structures been so clearly proved as in the case of these tombs.

With the indefatigability of bees, archæologists continue from year to year their search among the ruins of antiquity, bringing forth treasures of information to light up its history and aid in forming a picture of its civilization. Often from the most neglected remains unexpected light is thrown upon ancient institutions. For this reason, Dressel, in his study of the past, draws attention, in an interesting dissertation before the Roman Archæological Society at Rome, to the great importance attaching to the stamped bricks so extensively used in the structures of the ancient city. The city of brick which Augustus transformed into one of marble has become to us, in some degree, once more one of brick, for the spoliation of centuries has not torn from it its splendid marble mantle.

These bones of the grand skeleton have for us a special importance as genuine documents, confirming and correcting the other chronological sources. During the time of the first four emperors the kilns in Northern Italy were the monopoly of these rulers, but the enormous manufacture in Rome itself during this time was in the hands of private persons, particularly of one wealthy family, the Domicii, who furnished the city with brick from the middle of the first century for more than a hundred years. The tendency which had been increasing on the part of the emperors to get this industry more and more into their own hands was still more pronounced under Trajan, who appears on bricks as the proprietor of kilns, although under the concealed name, "Our Cæsar." More frequently still has been found the name of his wife, Plotina, who was the possessor of numerous kilns.

The series of consular dates on bricks commences before the death of Hadrian, to continue with some interruptions down to the year 164, the beginning of the reign of Marcus Aurelius. The question arises, Why this sudden interruption at this point. The answer is partly given by the annals of history. A terrible malady, brought from the Orient by the soldiers of L. Vero, invaded and devastated, together with Rome, a large part of the Roman Empire. During the whole reign of Marcus Aurelius, it scourged Rome and Italy, so that whole cities remained without inhabitants, towns fell to ruin, and the abandoned fields ran to forest. This blight on the city checked also the industry in brickmaking, although it does not explain why, from now on, chronological notices on the bricks should have ceased. In the family of Marcus Aurelius were united a considerable number of kilns, which may partly be explained by the fact that that emperor was the heir of Comicia Lucilla, of the family above mentioned. But the existence of many private kilns alongside of the imperial ones shows that the Administration did not aim at the complete monopoly of brickmaking, and with reason, for the factories were to a great extent in the hands of persons illustrious by birth and powerful by position, worthy of deference on the part of the reigning dynasty. In fact, among the number of these names, besides the high persons attached to the imperial house, were not a few lords and still more ladies belonging to the high aristocracy, consuls, knights, of many of whom no other record is left in history than is on the humble tiles.



High Altar in the Hospice des Vieillards, Villemomble, France. Brouty & Boussard, Architects.
From the *Moniteur des Architectes*.

The political shock which shattered the foundations of imperialism, and the events which followed are reflected also in the Roman bricks. Septimius, Severus, and Caracalla are not only the last emperors whose names appear in the stamps of the third century, but with them the production becomes apparently reduced to minimum proportions, and the custom of stamping, too, ceased for the rest of the period. The epoch of Diocletian and Constantine shows a revival of the industry, due to the extensive construction of new baths and other public edifices. The last period in the series of stamps is that of Theodoric and Atalaric, whose names are found quite frequently on a series of tiles.

Thus one of the last languid flashes of Roman life, before it spent itself in the darkness of a miserable ruin, found expression in the imprints on bricks. So, also, broken bits of pottery have their story to tell from the olden Roman time. Among the interesting results of modern investigation are those by Dressel concerning that unique object, Mount Testaccio, which has awakened the curiosity of so many strangers. The origin of this stupendous pile of broken fragments of pottery and glass has been explained as due to a grant made by King Tarquinius Priscus to the potters, an opinion based on the statements of learned men of the fifteenth and sixteenth centuries. De Rossi draws attention to the fact, however, that a still earlier writer, Nicola Signorili, gives quite a different explanation, saying that the Mount Testaccio, as the pottery bears witness, is made up of the piles of fragments of vessels in which the yearly tribute had been brought to Rome from the various provinces, and that any incredulous person may satisfy himself by examining the fragments, on which the names of the provinces are to be read. This was, moreover, the opinion with regard to the origin of the Mount prevalent among the populace of Rome throughout the Middle Ages, and furnishes a striking instance of how popular traditions may hold nearer to the truth than the wiseacres of science. Two archæologists, Bruzza and Dressel, on recently investigating the fragments of vases on the Testaccio, recognized

such provincial names, in particular those of Africa and Spain. Dressel, extending his observations, has also found many indications of the potter's industry on the left bank of the Tiber, opposite Testaccio.

Attention is turned by Helbig to a valuable witness in tracing the origin of the statue of the athlete turning oil from his right into his left hand. The keen eye of Braun had some time ago brought him to the conclusion that this type originated with Myron, basing his induction on the two replicas in the galleries of Munich and Dresden. There was, however, a missing link in his argument, since neither of the replicas showed properly the style of that master. This link is now supplied by a statuette in the possession of Baron Giovanni Barracco, likewise representing an oil-pouring athlete. The type of the face and the characteristics of the nude in this statuette correspond with the celebrated Discobolus, an undoubted original by Myron, and thus another glimpse is obtained of the style of this great master, who exercised so important an influence in carrying art from the quaint archaic types of early times over to the fewer productions of the age of Phidias.

We moderns have certainly made some advance in the manufacture of artificial limbs, if we may judge from the one found in a tomb in Capua. This rude invention was of wood from the ankle to about the knee, and the bronze covering extended fifteen centimetres above the wood. The vacant space thus formed doubtless served to receive the thigh. Into this upper part of the bronze were joined three or four iron pins, which seem to have served as attachments. In the "*Annali*" Rosbach discussed the ruined temple of Diana, situated on the lovely shores of Lake Nemi, which had been partly explored in the seventeenth century, but has yielded new treasures under the recent researches of Sir. F. Savile Lumley and Prince Orsini. Besides portions of marble statues, architectural fragments, and a quantity of inscriptions, there have come to light a great number of terra-cottas, especially votive objects, unquestionably in connection with the worship of Diana and mentioned by the poet Ovid (Fast. III, 263 fig.) as placed in this temple. Some of the terra-cottas were probably part of the architecture of the roof of the temple or an adjacent building, since one represents the goddess herself. Others are statues, either somewhat below life-size or smaller. The other terra-cottas, clearly votive offerings and made in the vicinity, were found in such quantities as to lead to the conclusion that there was here a depository for objects which, after being exposed for a long time, were set apart to make room for others. Many have strong resemblance to glazed objects found in Rome in systematizing the Tiber, the heads in both having a diadem around them, which has, however, no significance, but simply served the artist a good turn in concealing the jointure of the pieces from the mould. With few exceptions they are ordinary work, and do not reach beyond the first period of the empire. Votive hands, feet and legs, and animals, were also found, besides numerous objects devoted to the cast of Diana-Lucina, which refer to her as a deliverer in most various diseases.

The continuation of the excavation of Etruscan tombs at Carneto has brought to light a large number of most ancient graves which were found intact. For this reason Helbig finds them of great service in determining the original disposition of the objects found with the entombed. One class of vessels were found regularly at the right hand, the drinking vessels, such as cups, chalices and *kantharoi* at the left hand. The oil vessels (*unguentarii*) were likewise placed near the hands, while the plates, *olle* and other receptacles for food were placed near the head and feet. The metallic spirals, found together with iron earvings on each side of one body, go to show that these spirals which have caused much discussion, were certainly not earrings. The only other supposition is that they served as hair ornaments to bind the tresses and braids usual in archaic times. The principal importance of the recent excavations is the rich material furnished for the study of the ceramic art, and the opinion finds confirmation that many of the earliest Etruscan vases date from a time when the potter's wheel was not in use, or, at least, in so primitive a form as scarcely to be worthy of the name. Among the imported Greek vases the great numbers of *unguentarii* is most remarkable. Seventeen of these were found accompanying a single body, showing what great prominence unguents had in the commerce which the Turks carried on with Etruscans in the sixth century, B. C. The multiplicity of these articles seems to indicate that they occupied a position similar to those held by cotton stuffs and alcoholic beverages to-day in the relations of Europeans to the barbarous nations.

In the "*Annali*," 1885, Undset offers interesting thoughts on the most ancient Tarquinian necropoli of Etruria, based on the systematic excavations made since 1881 at Corneto. Etruscan tombs may receive a four-fold classification according to their age. The oldest form, a *pozzo*, are a simple pit excavated in the rock. In a narrow depression in the bottom was placed the hand-made ossuary for the cremated bones, or sometimes in a cylinder of nenphro, placed in the pit itself. These tombs contained primitive *fibulæ*, crescent-shaped razors and other small objects, all in bronze. Occasionally in the oldest of these tombs the singular hut-shaped urn, a rude representation of the earthly dwelling, and called capana urn, is used as the ossuary. At a somewhat later date the cylinder of nenphro is supplanted by a *dolium*, a vessel of glazed pottery. The second form of tombs, those *a fossa*, was an oblong cut in the rock, large enough to hold the skeleton, and shows the passage from cremation to burial. A third form, the tomb *a cassa*, differs but slightly from the last mentioned. The remains are, however, not interred directly in the rock, but first placed in a case of nenphro, a rudimentary form of sarcophagus. In these are found no cremated remains. A fourth class is to be noticed, the tomb *a camera*, consisting of a mortuary-chamber hewn horizontally in the rock. Of these the more ancient are without decoration, but characterized by the presence of Corinthian vases. At a later date they become more ornate with mural paintings, painted vases, etc.

The most interesting stage in the investigation of these ancient parts of the necropoli is that in which appears burial as taking the place of cremation. From this period the passage to the garnished sepulchral chambers of flourishing Etruscan art is clear and continuous. There are two theories on the subject of this introduction of burial without burning. The one is held by those who consider that the old tombs, *a pozzo*, with cremated remains belong to an epoch which they call Umbrian, anterior to the Etruscan, and that the first appearance of the Etruscans coincides with the new mode of sepulture. The other view is that there is traceable in all these tombs a progressive development, brought about by persistent and constantly increasing transmarine foreign influence. The advocates of the latter theory base it on the fact that the contents of the richest and latest of the *a pozzo*, or oldest class, are found equally in the more ancient tombs of the second and third class. The progress here, as elsewhere, must doubtless have taken place in the following manner: The rich and those holding high social position would be the first to receive the new and elaborate innovations coming from abroad, which then, in time, became more generally adopted. The cases would then be frequent where the poorer tombs with more antique objects and more simple equipments would be found alongside of those presenting more elaborate and more recent types. A touch of Nature is thrown around those old days when we find, as in some parts of the necropolis at Corneto, that the more ancient tombs had been disturbed by the grave-diggers of a later day. In excavating a late tomb, composed of two chambers, there was found near the entrance a semi-circular opening in the wall, which gave evidence of being the relic of an older tomb *a pozzo*. It would seem here that, to form the two sepulchral chambers it had been found necessary to destroy one or more older tombs. In the roof of the second chamber also was found a hole, across which was to be seen the ossuary for cremated bones, usual in the oldest times. Its bottom had been broken off by the roof of the newer burial chamber, but the contents had been treated with due respect and left intact. In another case, while digging, an old *a pozzo* tomb had been damaged, cutting off a part of the upper wall, but here also an attempt was made to repair the injury by walling up the aperture with stones, and so in other cases. This intrusion of later builders does not, however, prove, as has been claimed by some, that they were a hostile race, but can be explained by the great lapse of time, during which the earlier burial grounds would be lost sight of — an explanation the men readily accepted, since not the slightest indications have been found that the old tombs *a pozzo* had any visible monuments above ground. In some rare cases, it is true, the lapse of time may have weakened the feeling of reverence and so have caused the destruction of the sepulchres of long before. It is interesting that the large *fibulæ* of gold with their developed forms found in the more recent tombs resemble in style those found in the most ancient. They testify to the great length of time which elapsed and the holding on to these forms, even after the *fibulæ* in actual use had received much more modern shapes, forces to the conclusion that they were fabricated especially for burial and sacred purposes. Still further confirmatory of this uninterrupted connection is the finding of inscriptions on vessels in ancient tombs, as at Valci, showing that the oldest type of tombs was in vogue even after the introduction of the alphabet. Following up the analogies of these most ancient tombs of Corneto throughout Italy, which he finds to be of astonishing extent, Undset then discussed the origin of this group, and the mode in which it was formed and extended. Here the first inquiry is whether these regions offer anything from an epoch still older which could possibly give the incentive to and furnish the germs of this growth. These more ancient remains seem to be those found in North Italy in the lake dwellings and *pfahlbauten* of the age of bronze; here the cremated bones are in *ossuarico*, sometimes with vases and utensils of bronze, similar to those of the oldest tombs of Bologna. While it is not possible to enter fully into the subject here, it may suffice to say that the widely-extended prehistoric civilization, traces of which have been found so extensively in Central Eastern Europe, as in Hungary, marks a movement from north to south, and formed the remote antecedent of the oldest necropoli of Italy. In tracing the connection of the objects found we look outside of Italy. Here Olympia, in Greece, first claims attention with its numerous objects in metal, brought to light in recent years, which present a great variety of forms, already recognized in Italy. So also the Attic necropolis, the Dipyon, yielded objects analogous to those of Italy. They are also found in the remote Caucasus, in the Troas, Cyprus and North Africa. The necropoli of Kameiros and Ialysas, on the Island of Rhodes, have furnished many objects perfectly corresponding to the ancient group in Italy. This coincidence in the finds in tombs on the coastlands of the Mediterranean, as well as other reasons, lead at once to the thought that the Phœnicians were the mediators of this diffusion. The influence of foreign importations in Etruscan art, so marked in later times, can be traced also in the oldest tombs *a pozzo*, as seen in

a few scarabs, the glass pearls and other small objects found at Corneto, Cologna, etc. The architectural style is also under foreign influence. This is evident in the transmutations of Egyptian and Phœnician symbols; in fact, the same motives are traceable here as in the Greek style of the Attic graves of the Dipylon. Thus early Etruscan and early Greek were surrounded by the same influences, but how different the growth from the same seed in the different soils. In fact, it is evident that foreign influence became so strong in Etruria as to supplant the older funeral rite of cremation by the universal Oriental custom of burial.

Before closing I cannot fail to mention a discovery of great interest just made in Rome, beneath the Church of SS. John and Paul, by the Passionist father, Père Germano. Under the principal altar were found at first two rooms of a Roman house of the fourth century. On exploring further a third room was uncovered, seven metres long and four meters wide. Professor Gatti judges this, from its position and size, to be the Tablinium. The parts which have been exposed show remarkable paintings. In the Tablinium, besides the pagan pictures, representing animals, hippocamps, country scenes and allegorical decorations, there were also Christian subjects. These were, among others, Moses removing his sandals before ascending the mountain, a scene like that found at St. Calliste; a woman in attitude of prayer, dressed in a dalmatica, having a veil on her head and a necklace of pearls about her neck. This is the first instance in which Christian paintings have been found in a noble house. Heretofore we have been confined to the rude productions in the catacombs from the hands of the persecuted early Christians for witnesses to Christian art of that time in Rome. — *Lucy M. Mitchell, in the New York Times.*

SOCIETIES

ART ASSOCIATION OF MASONIC TEMPLE.

A NUMBER of the Craft, having knowledge of the success of the Art Association of the Union League, Philadelphia, conceived the idea of forming a similar Association to decorate the Masonic Temple; and to consummate the idea they issued a circular to the various Lodges meeting in the Temple, asking their coöperation.

In response to that circular, thirty-five (35) Lodges took favorable action, and at a meeting held in the Temple, on October 22d, 1887, the Art Association of the Masonic Temple was organized, with over fifty members, and the following officers were elected: —

President, Bro. Clifford P. MacCalla; *First Vice-President*, Bro. Wm. T. Krumbhaar; *Second Vice-President*, Bro. Chas. M. Swain; *Third Vice-President*, Bro. Chas. J. McClary; *Treasurer*, Bro. John J. Gilroy; *Secretary*, Bro. Singleton M. Brice.

The annual dues were fixed at one dollar a year, and twenty dollars for life membership. The money derived in this way is to be used to purchase works of art, viz.: paintings, statuary, bronzes, as well as to decorate, as far as the means permit, and the Temple committee approve, the various rooms in the Temple with fresco, stained-glass windows, etc.

Conceiving the idea to be a grand one, and having in our beautiful Temple such a wide field of operation, and as all Freemasons are especially urged to cultivate the Arts and Sciences, and to take all opportunities to improve themselves therein, we feel that no more fitting object could be attained than making our Temple the depository of all that is beautiful, as well as instructive, thus carrying out, in fact as well as in spirit, the noble teachings of our Fraternity.

As the greater number of members the Association enrolls, the more work it will be able to accomplish each year, it is hoped that all Master Masons will do their part to help on this great work, by becoming members themselves, and by influencing their friends to join the Art Association of the Masonic Temple.

SINGLETON M. BRICE, *Secretary*,
NO. 142 S. THIRD STREET, PHILA.

COMMUNICATIONS

THE UNJUSTIFIABLE DISMISSAL OF AN ARCHITECT.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — Should an architect, at the request of a town committee, prepare preliminary drawings and make approximate estimate for a town building, with the distinct understanding that, should his plans be approved by said town, he would be employed to carry out the work (no terms being mentioned but the regular schedule of A. I. A. posted in conspicuous place in office), and, after the approval of said plans, money appropriated, and building committee appointed, another architect appears, who agrees to carry out the work for less sum than architect No. 1, by which method he obtains the work.

In this case what would be the proper charge for architect No. 1 to make? — cost of building would exceed $10,000. Also, should new drawings be produced with minor changes (but substantially the same as originals), for reasons best known to building-committee, would that relieve town from paying for the originals, which are on record as being eminently satisfactory.

Should be exceedingly grateful for your early opinion.

VICTIM OF BAD FAITH.

[THE first architect should insist upon his right, and signify unmistakably his willingness to carry out the work for which he seems to have been employed in due form. If the town then prefers to throw up its contract with him, it must still pay him just what he would have received if the agreement had been carried out to completion. This, in such cases, is usually reckoned at five per cent on the proposed cost of the work, less what he would probably have had to pay out for draughtsman's services, office-rent, etc., in doing the work which the employment of another architect in his place has relieved him of. The exact amount to be paid is a matter for the jury to decide, but the five per cent custom is so well established that it is generally accepted by courts as a fair estimate of the proper compensation for architects' services in buildings of importance. If the aggrieved architect has, in addition, suffered direct damage in reputation by unjustifiable deprivation of his commission, he is entitled to extra compensation for this. The use of his plans by the second architect, although it speaks ill for the honesty of the building-committee, might possibly be justified, *if* the town had paid their author the full price for his services on the ground that the plans thus paid for belonged to the town, and could be used in any way it pleased. — EDS. AMERICAN ARCHITECT.]

NOTES AND CLIPPINGS

PURPORTING TO BE MIRTH-PROVOKING.

FLATS AND KEYS. — If a hotel is built in four flats, what key is necessary to open it? — *Musical Herald.*

SITES. — When the Government wants a building site it takes a sight of money to secure it. — *New Orleans Picayune.*

WHY POMPEII WAS ENTOMBED. — The Cogswell fountain on Boston Common is said to be a *fac-simile* of one exhumed from the ruins of Pompeii. We know now why Pompeii was destroyed. — *Boston Courier.*

THE CHIEF ORDER OF ARCHITECTURE. — The principal order of architecture is an order for another $10,000 for necessary changes in the original plan. — *Exchange.*

FROZEN MUSIC. — Said a Boston clergyman the other day: "If architecture be frozen music, there will be terrible noises when some of our New England churches thaw out." — *Exchange.*

PUTTING IT PLEASANTLY. — Sir Pompey's architect (producing a plan): "There, Sir Pompey, I flatter myself I have made that drawing plain to even the meanest capacity." — *London Punch.*

A SAWYER'S MOTTO. — A prominent timber merchant has had his coat-of-arms painted on the panels of his carriage, with the Latin motto, "*Vidi,*" which, by interpretation is "I saw." — *Timber Trades Journal.*

STAINED-GLASS. — A fashionable lady, in boasting of her new "palatial residence," said the windows were all of stained glass. "That's too bad!" cried her mother; "but won't soap and turpentine take the stains out?" — *Exchange.*

TRUE TO THE FAITH. — The Rector (to Irish plasterer on ladder pointing a wall): That mortar must have been very bad. Pat (with a grin): Faix ye can't expict the likes o' good Roman cimint to stick to a Protestant church, sorr! — *Punch.*

SIGNED A COMPACT WITH THE DEVIL. — A liberal brewer once built a church at his sole expense; but the stone engraver cut the stone which was to immortalize the brewer's name with, "Built by ———, at his soul's expense." — *New Haven Palladium.*

WE see that a bizarre building in Chicago is to be decorated with "life-size griffins in terra-cotta." That is like Chicago. In no other city in the world would an architect profess to know what is "life-size" for an imaginary creature which never lived at all. — *Buffalo Express.*

FLATS. — Are French flats healthy? Yes, very. Are the people in them healthy? No. Why? They have to starve and go half naked to pay the rent. Why are these flats called French flats? To distinguish them from American flats. What are American flats? The people who live in French flats. — *Life.*

THE ARCHITECT OF NOTRE DAME. — The *Figaro* revives an old story of Victor Hugo travelling in the South of France. One of the townspeople told the innkeeper that his guest was the author of "Nôtre Dame de Paris." "What," said the surprised innkeeper, "that famous architect living yet?"

THE ETERNAL FITNESS OF THINGS. — "I'm going to have a crayon of my father hung over the mantelpiece," remarked the proud owner of a new and beautiful mansion as he expressed his perfect satisfaction with the decorations of the library. "Oh, pardon me, it is impossible!" exclaimed the architect. "The room is Turkish!" "All right," said the master of the house gravely. "Of course, we musn't spoil the decorations. But if I have the artist touch him up a little, and put a fez on the old gentleman's head, you'll let him in, won't you?" — *The Epoch.*

An Architectural Metamorphosis. — "If Mr. Garrett has really sold his stock in the Baltimore and Ohio Railroad, the transaction is a most singular metamorphosis," observed the Snake Editor.

"How can a sale be a metamorphosis?" asked the Horse Editor.

"It converts a Garrett into a seller." — *Pittsburgh Chronicle.*

Promise of a Busy Career. — A young mother consults one of her friends upon the profession she ought to give to her son. "The child troubles me; he is of a dreamy nature and taken with the ideal." "Make him an architect, my dear madame," replies her friend. "He will then be able to build castles in Spain." — *From the French.*

Overburdened Columns. — "I have a little ornamental work I should like to submit," said the Carved Design to the Corinthian Temple.

"Thanks," replied the Temple, "but the pressure upon our Columns is so great that we shall have to Decline your Offer." — *Burlington Free Press.*

Building Material Lacking. — Mr. Lincoln, when he was a lawyer in Springfield, Ill., happening to be present at a debate where a man, getting up, repeated the words, "I build," several times without being able to proceed with the thread of his argument, remarked in a loud whisper, "The gentleman is stopping in his building for want of material." — *New York Graphic.*

Building an Addition. — Wife (to husband) — This house is altogether too small for our needs, John. Why don't you put an addition to it?

Husband (thoughtfully) — I've been thinking of that.

Wife — Something in the shape of a wing?

Husband — No; something in the shape of a mortgage. — *Exchange.*

A Serious Nursery Quarrel. — Tom — "We've got a bay window in our house." Bessie — "So have we. And a Balcony." Tom — "Pooh! That's nothing. We have two bath-rooms." Bessie — "So have we." Tom — "We've got something you folks haven't. I heard papa tell mamma about it last night." Bessie — "I'll bet we've got some of 'em, too. What is it?" Tom — "A defective flue." — *Philadelphia Call.*

Decorated Interiors. — Mrs. Graham is an estimable lady, whose hobby is house decoration. One day last spring Mrs. Graham was careless enough to drink a glass of red ink, believing it to be claret. She was a good deal scared when she discovered her mistake, but no harm came to her. The doctor who was summoned, upon hearing what had happened, dryly remarked to her: "Mrs. Graham, there's such a thing as pushing this rage for decorated interiors too far." — *New York Tribune.*

Mrs. Malaprop as Cicerone. — Some visitors were going through a great house recently, and at length paused before a fine painting representing a handsome, black-bearded man in gorgeous attire. One of them inquired of the guide whose portrait it might be. "Well, sir, replied the housekeeper, "I don't rightly know; but I believe it is the Dowager Venus." "But," said the visitor, "I scarcely think that the Dowager Venus would be represented with a beard. Perhaps you will be good enough to look in the catalogue." She did so, and the Dowager Venus proved to be the Doge of Venice. — *London Society.*

Safe Enough. — *First Small Boy.* — "What does your pap do for a living?"

Second Small Boy (from New York). — "My pap's a great man, he is He is an office-holder."

"What's his office, then?"

"He's a building inspector."

"I'd think that would be awful dangerous going around unsafe buildings."

"Oh, no. He don't go near 'em till after they fall down."

— *Philadelphia Evening Call.*

An Unreasonable Landlord. — X, the architect, who died a few years since, in his early years was impecunious but disposed to get all he could out of life. On one occasion he was arrested for debt, and went before a magistrate to take the poor debtor's oath. He was questioned sharply as to his style of living. He admitted that he boarded at the Tremont House, then kept by Paran Stevens, and that he paid $60 per week for board. "But," said the magistrate, "don't you think that is a pretty high price for a poor debtor to pay?" "That's what I've been telling Stevens all winter, but it has no effect on him." — *Boston Every Other Saturday.*

The Houses I've Built. —

I wish you could see all the houses I've built;
Such houses you nowhere can find,
I've done them without architectural aid —
The houses I've built in my mind.

The windows and blinds, and the ceilings and floors
Beat everything yet of their kind,
The walls and the stairs and the mouldings and doors,
I see them all now in my mind.

The plumbing all done at the highest of rates,
(The plumbers their talents combined)
Loud tells of my wealth as I laugh at the Fates
In the houses I've built in my mind.

O leave you, my friends, all your mansions so grand!
Don't even put it off till you've dined!
For never were palaces in this broad land
Like these I've built in my mind.

— *Exchange.*

TRADE SURVEYS

The arguments and figures set forth by some building-trade authorities going to show the probable extent of building operations next year possess the merit of careful investigation, but lack the valuable factor of reliability; besides, the building probabilities of our larger cities, even if correctly anticipated, count for very little in the great make-up of building probabilities in another country. Even counting that less building will be done in New York, Philadelphia, Chicago and St. Louis, which is by no means certain at this time, it does not follow that there will be a falling off in construction throughout the country at large. In fact, a careful observation shows exactly the contrary. It is a fact that in a multitude of smaller manufacturing cities, towns and villages that a great deal of building has been determined upon for operatives and the well-to-do class whose earnings run from seven hundred and fifty to fifteen hundred dollars a year. A large amount of building of this kind will be done during 1888. Activity of this kind will not be confined to any one city or number of cities, but will extend from Boston to San Francisco. Even in Duluth real-estate values are rapidly enhancing. This booming city is not an exceptional one in the Northwest. There are a score of towns rapidly rising into importance and builders in the Northwest express the opinion that that great section will attract as much building enterprise and capital in 1888 as this year. Lumber manufacturers and dealers anticipate as heavy a demand and a heavier one. Extensive preparations are being made to supply all the material which goes into domestic and manufacturing requirements. Abundant authorities can be found for the statement that what we lose in building activity in cities we will make up in activity in rural and semi-rural localities. The lumber manufacturers expect to manufacture as much lumber this winter as last. A high lumber-authority states that, overlooking the entire field and carefully scanning the conditions, it is safer to anticipate no boom in lumber next year, though there is good ground for believing that stocks on hand can be worked off at ordinary values, while an advance on good and common strips and wide boards may be realized. The car-factory demand is likely to be nearly as much next year as during the present one. In the country west of the Lakes the prospect is that there will be a place for all common lumber now on stick and at prices a little better than those now prevailing. Stocks on the Mississippi River are moderate. There is estimated to be 300,000,000 feet of lumber piled on Saginaw River, which is 15,000,000 feet less than last year. The rail shipments from the Valley for this year amount to 239,000,000 feet against 176,500,000 feet in 1886. The prospect for lower freights to the Missouri River will help to stimulate lumber shipments to that region, which is a most important market for the Northwest. The same authority states that never before in any one season was there such a demand for oak to go into both house-finishing and furniture as during the one about to close. Agricultural implement and machinery manufacturers are looking about for material. Some financial authorities are endeavoring to make something out of a disproportion between the increase in gross and net earnings of a large number of railways. A table has been recently published, giving the gross and net earnings of fifty-seven roads for ten months, showing that while the gross increase was eleven per cent the net was but eight. This is explained by the fact that all these companies are expending money more liberally for betterments of all kinds, from locomotives down to machine-shop stock. It is this very liberality of investment that has made business what it is; instead of being a discouraging factor, it is the reverse. The granger-roads, coal-roads and now the cotton-roads are all earning good dividends, and the volume of traffic for the winter will probably make the reports for the coming three or four months sufficiently encouraging and to even still further stimulate the desire for railway construction. A vast amount of money is spent without the most careful consideration, and it may be that the fever for restriction may overtake the investing public just as the fever for expansion has done, but the bald facts of the situation justify a very great deal of railroad-building next year. It is true that the earnings of capital invested in railway property are gradually getting smaller. The percentage of interest and dividends on stocks, bonds and debt of the railroad companies of the country for the past four years have been respectively as follows: 3.68, 3.52, 3.36, 3.26. The earnings of railroads for passenger traffic per mile were for the same years 242, 235, 219, 218. The earnings per ton mile were 123, 112, 105, 108. This declining tendency, however, is no justification of a restriction policy. The earnings are still sufficiently large to attract capital; besides, opportunities for assured heavy profits are fewer and investors are obliged to seek new opportunities. The most encouraging opportunity is that of land, which in all probability will rapidly advance in value during the next ten or twenty years. Two railroads have recently been projected, one from Mile City, Montana, to Galveston, and another from some northern town in Montana to El Paso, Tex., both of which are well backed by capital, not only for the purpose of traffic, but for the purpose of providing for the expansion in land-values which will naturally follow, not only because of the construction of these two lines of road, but because of the demand for land by the outgoing population from the East and abroad. Land-speculation, instead of declining, must, of necessity, increase. Land-buying is the basis of future fortunes. Chicago railway-managers expect to patch up a peace between themselves, which will enable them to prevent a cutting of rates through the winter. The large buying interests in all directions are out of the market until after the holidays. Railway requirements that have not yet been presented will be held until January. Locomotives and car-works, ship-yards and large manufacturing establishments are more interested in completing contracts in hand than obtaining new ones. Despite the statements to the contrary, there will be an immense amount of new business placed next month, not only by railroads, but for manufacturing establishments, large and small. The petty fluctuations in the market-values of cereals, cotton, provisions or even iron and steel, have very little influence upon the great agencies and influences which are underlying the developments of this country. They are moving forward steadily and cannot be held in check by stock-jobbers or highwaymen in the avenues of trade. The entire industrial situation is as pleasing as could be desired. The anthracite coal-trade is very active, and last week the production reached nearly 850,000 tons. The production for the year will be 35,000,000. The iron trade is strong, but not very active at present. The distribution of lumber is maintained at its maximum limits and the fair weather thus far has encouraged a much larger distribution than is to be expected at this season. Prices are strong. The machine-shop demand for iron and steel and all products is still a very important factor, and railroad companies are large purchasers of shop-supplies in the West and Southwest.

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HELIOTYPE PRINTING CO BOSTON

FIREPLACE IN HOUSE BUILT FOR HENRY VILLARD, ESQ., NEW YORK, N. Y.

McKIM, MEAD & WHITE, Architects.

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CONTENTS

IN spite of the opposition of the old gas-companies and the real risks attendant upon its use, the employment of water-gas is becoming more and more common all over the world, and there is certainly reason for hoping that ways may be found for making so cheap and clean a fuel generally available without danger. In Belgium, where everything relating to domestic economy is deeply studied, the future of water-gas heating is a matter of much importance, and *L'Emulation* contains an essay on the subject which has an interest from several points. According to this essay, which is by M. Alexandrowicz, experiments made in Essen by MM. Schultze and Knudde have shown that with a ton of the refuse broken coke which is rejected by manufacturers, from being so small as to fall through the grate-bars, thirty-five thousand cubic feet of good water-gas can be made. The coke costs a dollar and a quarter a ton, and the cost of manufacture, together with general expenses, interest on capital, and contribution to the sinking-fund, is reckoned at a dollar and forty cents more, so that the total cost of the gas at the works is seven and six-tenths cents per thousand cubic feet. In Stockholm, where similar experiments have been made, the total cost is slightly greater, but in any place where coal or coke "slack" can be readily obtained, the water-gas can be made on the other side of the water for less than ten cents per thousand feet, including all expenses, and if sold at twenty cents per thousand feet will pay an enormous profit. This seems incredibly cheap to us, who are accustomed to pay ten or fifteen times as much for coal-gas, but it must be remembered that the foreign water-gas is not directly used for illumination. In America it is found profitable to "enrich" the water-gas by passing it through tanks of naphtha, or adding some other hydro-carbon, and thus fit it for sale in competition with ordinary illuminating gas, but in Europe naphtha is much more expensive than with us, while the cost of ordinary coal-gas is only about one-fourth the American standard, so that water-gas there comes chiefly into competition with coal, as a fuel only. For this use the Stockholm experiments have shown it to be very well adapted. A piece of beef weighing eighteen pounds was roasted by the gas-flame, and found to require the consumption of twenty-one feet of gas, while sixty-two cubic feet of gas per day, on an average, sufficed for all the cooking and warming required for a family consisting of three adults and three children. Supposing the cost of water-gas to be twenty cents per thousand feet, the total expense for fuel of this family would average a cent and a quarter per day. The climate of Stockholm is far colder than that of Belgium, yet in Antwerp and Brussels the average outlay for fuel in such families is from six to seven cents per day. This, it must be remembered, is for working-men, who use the same stove for heating and cooking, and, as may be imagined, the cost of fuel is with them a large item in their living expenses, often amounting, in that country of low wages, to one-tenth of the householder's income. With us, we suppose that similar families would spend about the same sum for this purpose, which, of course, would be a much smaller part of the total family income, but even our comparatively affluent workingmen would like to save twenty dollars a year out of their coal-bills, to say nothing of the great economy of trouble and time incident to the use of gas-fuel, and with the poor Belgians this would seem an enormous gain. The main objection to the use of water-gas has hitherto been its poisonous quality, and the absence of any odor by which its presence in a room can be detected, but one of the German water-gas companies avoids this difficulty very ingeniously by putting perfumes in the meter, and distributes a list of thirty-six aromas, out of which its customers may choose the one which, when combined with suffocation, would be most soothing to them. The question of utilizing the pure water-gas for illumination has also been resolved in a promising way, by using the gas mixed with air for producing a very hot flame, which will raise to brilliant incandescence a thread of lime or magnesia exposed to it. This problem has been very successfully studied by a Swedish inventor, M. Fahnjelm, and the Fahnjelm lamps now give a light which, for equal illumination, costs less than one-fiftieth as much as that from the best burners with ordinary coal-gas. It has always seemed to us very injudicious to load the manufacture of water-gas with the attempt to carbonize it for illuminating purposes, and if the Fahnjelm lamp could be made generally available, and, through its use, the water-gas be sold for illumination as well as heating, without artificial additions, there can be no question that its use would soon receive a great development.

A NEW process has been patented in most civilized countries, for making Portland cement, by means of an oven which exposes the powdered raw material directly to the action of a flame of gas. The ordinary process in the best establishments is at present to grind the chalk, or lime, and clay thoroughly together, make the mixture, with the aid of water, into balls or bricks, dry, and burn to partial vitrification, then grind again to a fine powder, which is the cement of commerce. Where the demand for the product justifies the expense, it is usual to do the burning in a Hoffman, or ring kiln, which consists of ten or twelve compartments, arranged in a circle, and heated successively, so that the spare warmth of one which has just been used for burning serves to dry, and raise to a certain degree of temperature the fresh material with which it is refilled. The coal or coke used for burning is put into the compartments from the top, with the bricks of chalk and clay, and the draught is arranged to draw the product of combustion from the one in operation through the others, which are thus warmed, and fuel saved; and as one compartment is always burning, the production of cement is continuous. The principal defects in this process consist in the necessity for making the chalk and clay into bricks, which must be dried before burning, and ground afterward, and the liability of the finished cement to deterioration by mixture with ashes from the coke which is used to burn it, and the new process, which is due to Herr Sonnet, of Bernburg, in North Germany, avoids both these by burning the raw materials in fine powder, just as they come from the preliminary grinding, with the aid of a gas flame, which carries with it no dust or ashes of any kind. To do this an oven is constructed of fire-clay pipes, making a line undulating in a vertical plane. At the side of the line of pipes is the gas generator, consisting of a retort in which coke is burned upon a grate through which superheated steam is blown. The steam is decomposed, forming with the coke which it takes up, a mixture of hydrogen with various hydrocarbons and carbonic oxide, and this gas, after being allowed to expand in a chamber of considerable size, upon the walls of which it deposits the tarry matters contained in it, is admitted through openings in the side to the fire-clay pipes which run close by. Over the top of the line of pipes, and receiving heat both from them and the gas generator, runs a cylinder containing an Archimedean screw, by which the powdered clay and chalk are drawn from the discharge pipe of the mixing mill over the top of the oven to the first bend of the zigzag pipe, and are then dropped into it through an opening arranged for the purpose. As the raw powder falls into the tube, it is met by a blast of air rushing upward, mixed with gas, which enters into furious combustion with the new supply of oxygen; and is carried forward by the wind and flames through the successive undulations of the pipe, until the last and lightest particles are intercepted by a "baffle plate" in the outlet flue. The burned dust, on its way through the tube, falls gradually to the bottom of the depressed portions, and is

removed, as it accumulates, by openings placed there for the purpose. So long as coke and steam are supplied to the gas generator, and chalk and clay to the Archimedean screw, the action of the kiln is continuous; while the finished product not only needs no further grinding, but, from its freedom from coke-dust and ashes, is said to have a tensile resistance sixty per cent greater than that of the best cements made by the old process. At first sight it would seem that the quality of the cement, some particles of which are so heavy as to fall immediately to the bottom of the first portion of the pipe, after a very short exposure to the calcining flame, while the finest portions pass through the whole length of the hottest portion of the oven, would vary, but a suitable mixture of the different portions is probably made, and the cost of production, through the saving in expense of preparation and handling, is much less than by the old process.

A CURIOUS engineering operation has just been carried out in France near the Belgian frontier. Near the town of Condé the River Haine, a navigable stream, flowed until recently into the larger river Scheldt. The latter stream, near the mouth of which is the great seaport of Antwerp, is of much importance to inland navigation, and the shallower portions have recently been "canalized" by means of embankments, so as to improve and maintain the waterway. In canalizing the Scheldt, it was found advisable to allow the Haine to cross it, reaching a different outfall beyond, instead of losing itself in it at the original confluence, and the dikes were arranged in this way. Experience showed, however, that the Haine brought down so much alluvium as to affect sensibly the channel of the Scheldt at the intersection, and dredges were kept in almost constant use to keep the navigation clear. To obviate the necessity for this, it was decided to carry one river entirely under the other by means of inverted siphons, and the work has just been completed. Five riveted wrought-iron tubes are used, each eleven feet in diameter, dipping about ten feet below the usual water-level and buried in a mass of concrete, which is formed to the profile of the bed of the Scheldt. Each siphon was made in three pieces, the middle portion weighing twenty tons and the end pieces ten tons each, and, after diverting temporarily the course of both rivers, the tubes were laid in place, riveted together, and the concrete filling put in. At the same time the tubes were lined with a ring of brickwork covered with cement, and when all was finished the water was turned through them. What will be done with the silt which is sure to collect in the lower part of the siphon does not appear, but it is probable that some simple apparatus will be used for extracting it, and there is in this case no navigation to be looked out for.

BERLIN is, above all others, the city of apartment-houses. As in New York, the enormous price of land has led to the crowding of population in limited areas, and to the horizontal instead of the vertical subdivision of houses. Many of the German houses of the sort are very well planned, and the tendency would probably be, as in New York, to increase the height almost without limit, for the sake of adding to the capacity of the building, were it not for a police regulation, recently issued, and enforced with the unrelenting exactness characteristic of the Germans, which restricts the height of such buildings to a maximum of twenty-two metres, — about seventy-two feet, and forbids the use of more than five stories for habitation. Practically, the ground-floor, with the basement, if there should be any, is generally occupied for business, leaving five stories for dwellings. According to the *Deutsche Bauzeitung*, the upper stories are there, as here, the pleasantest to live in, having more light and air, and being much quieter, than those nearer the ground; but the labor required to reach them over the rather steep German stairways is so great as to overbalance the other considerations, and although the upper stories are apt to be rented first, they bring low prices in comparison with the apartments below. Within a year or so several houses have been fitted with elevators, more particularly with those known to us as the Otis, or, from the name of their inventor, the Hale elevators, which are very extensively used abroad, and the *Deutsche Bauzeitung* appears to be quite overjoyed at the result, finding that the use of them will make the upper flats of apartment-houses, with their pure air and freedom from dust and noise, as accessible as the lower ones, and thus, to a great extent, solve the problem of wholesome living in the crowded city. We hope that these anticipations will be realized, but as Americans, accustomed to the use of elevators in stores, hotels, concert-halls, theatres, office-buildings and apartment-houses, as well as in very many private dwellings, inhabited by a single family, we may warn the Berlin builders that such machines will do little to increase the rental value of the upper floors of their houses unless they look carefully after the construction of the building. Fifteen years ago, most people thought that the apartment-house, with the elevator, presented the perfection of city habitation, and that the upper floors, with their endless possibilities of light, and their neighborhood to the splendid roof-gardens which, in imagination, adorned the city, would be not only the most desirable, but the highest-priced. A fire in a "fireproof" apartment-house, by which the ninth story, containing the beautiful dining-room and other public rooms, was gutted in a few minutes, excited the first misgivings as to the advantage of living so high above the ground as to be out of reach of firemen's ladders; and other fires of a similar sort, occurring in rapid succession, confirmed the bad impression left by the first. However pleasant it may be to breathe pure air, and to enjoy so beautiful a prospect as some of the upper flats in the New York houses afford, it is still pleasanter to be tolerably sure of escape in case of fire, and as experience has shown, by many sad occurrences, that even in many so-called fireproof buildings those who live in the upper stories must inevitably be sacrificed if fire should break out in the building, the upper flats are now about as much at a discount as ever in New York. It may be that the German architects can manage their buildings better. If so, in so flat a place as Berlin the upper stories will unquestionably be much the most desirable.

THE *Sanitary Plumber* makes an emphatic protest against something which it finds in the *Metal Worker*, to the effect that technical and trade schools have little practical value, for the reason that the public does not care for skilful work, and will not pay what it is worth, and that, therefore, the sort of mechanic who is most in demand in the labor-market is not the trained and intelligent man, but the cheap man, who can turn out work rapidly, without regard to quality. It is only fair to the *Metal Worker* to say that it does not present this as its own view, but only as the opinion of certain "leading practical mechanics" in England, an opinion which, it is hardly necessary to say, the *Sanitary Plumber* does not share. On the contrary, it gives, as its own experience, that out of scores of master-plumbers, who have applied to it during the past year for assistance in obtaining journeymen, not one has ever indicated a preference for men of mediocre skill, but the invariable phrase has been, "We want first-class men; there is no money in cheap help." We think the experience of all persons in this country who hire assistance, or who are acquainted with the wishes of those who do so, would emphatically confirm this statement. For one application which is made to us for a "student," or a cheap draughtsman, we have at least six from persons who wish for "a first-rate man," "one capable of taking full charge of an office," and so on; and the suggestion which we sometimes make, that men of this sort expect a liberal salary, is always met with the reply, "We will pay whatever he is worth; only send the man as soon as possible." In many of the cases we are unable to comply with the request, as the demand for such men in architects' offices far exceeds the supply, and it may be considered certain that the English preference for inferior workmen, if it exists anywhere, is certainly not found in the architectural profession in this country. Whether it is more common among builders we cannot say, but have serious doubts on the subject. There are certain building operations which can be executed by ignorant and clumsy men, and many builders employ such to do work of the kind, but we think that the richest and most enterprising builders, who are obliged to carry on their extensive transactions with the greatest prudence and economy, tend strongly toward the employment of none but the most intelligent and skilful men in every department. On the assistance of the very best mechanics such contractors place the highest value, rarely allowing a man to leave them who has shown unusual skill, so long as liberal wages and kind treatment will keep him attached to them; and if, through any misfortune, such a mechanic loses his position, he is generally taken up immediately by some rival contractor.

ANCIENT AND MODERN LIGHT-HOUSES.[1] — XVII.

FOURTEEN-FOOT BANK LIGHT-HOUSE, DELAWARE BAY.



Fourteen-foot Shoal Light.

FOURTEEN-Foot Bank Shoal is situated on the west side of the main channel, about 3½ miles from the Delaware shore, 10¼ miles northeast of the mouth of Mispillion Creek, and 14½ miles north 51° 15′ west from Cape May Light.

This shoal, which is a turning point in the navigation of the bay, was marked in 1876 by a light-ship. Owing to floating ice, the light-ship could not remain at her station during the winter months, when it is very important to have the location of the shoal defined.

In 1882, the year after the disaster to the first caisson attempted to be placed on the Rothersand shoal, the Light-house Board of the United States considered the desirability of replacing the light-ship by a permanent structure, and several projects for the foundation pier were entertained. They all embraced the general features of a cast-iron pier filled with concrete. Different forms of vertical section for the pier were proposed and discussed; finally in 1883, a cylinder, 73 feet in height and 35 feet in diameter, was adopted by the Board, on the recommendation of Major D. P. Heap, Engineer Secretary of the Board.

This cylinder was to be composed of 1½ inch cast-iron plates, 6 feet in height, with 6-inch horizontal and vertical flanges, 1¾ inches in thickness; it was also required that these flanges be planed so that the joints could be made water-tight.

A cylinder such as recommended presented the advantage of simplicity of construction; all the plates, being of the same size, would be interchangeable, a decided help in putting the cylinder together at the site.

By Acts of Congress, approved August 7, 1882, and March 3, 1883, the Board had, at its disposal, the sum of $175,000 for the entire completion of this work.

The contract for furnishing the metal-work of the cylinder was awarded to the G. W. & F. Smith Iron Company, of Boston, Mass., who delivered it on the Government Pier at Lewes, Del., on July 19, 1884.

The general figure of the shoal is oval in plan; its length, measured up and down stream between the 24-foot curves, is 5,720 feet, while its width is 1,300 feet. The least water at low tide was 20 feet. Borings were made to the depth of 26 feet. The material penetrated was very fine, dark sand, mixed with shells, and was so compacted that a strong water-jet was necessary to force down the 4-inch wrought-iron tube used in making the borings. It will be noticed that the depth of water and the nature of the bed of the sea were nearly the same here as at Rothersand.

The average rise and fall of the tide were found to be 6 feet, and the maximum velocity of the current about 2 miles per hour.

On the 20th of December, 1884, bids were invited to build and sink the cylinder so that its bottom would be 23 feet below the surface of the shoal: this would place it on the same level as the bottom of the adjacent main channel in its deepest part; bidders were not restricted to any one plan for sinking the cylinder, but were allowed to use any process they pleased subject to the approval of the Board, and were required to give security that in case the metal-work was lost or injured from any cause while in their hands, they would make good the loss to the Government.

The bid of Messrs. Anderson & Barr, of New York City, in the sum of $38,900, was accepted, and as security they deposited $20,000 with the Treasurer of the United States; they proposed to use the pneumatic process, the Government furnishing the cylinder and the cement required for 2,000 cubic yards of concrete.

For a working-chamber they built a square wooden caisson on which the cylinder was to rest, its details are shown in the drawing, [See illustrations] as this caisson was 10 feet high its lower edge had to penetrate the sand to a depth of 33 feet, in order to bring the bottom of the cylinder to the stipulated depth.

It was built of 12 x 12 inch yellow pine, and lined with 1¼ inch tongued-and-grooved stuff, laid in white-lead. The joints of all adjoining timbers were caulked and filled with mineral pitch; a sheathing of 2-inch yellow-pine planks was placed on the outside. Work on the caisson was commenced on the beach at Lewes, Del., in the latter part of May, 1885; to facilitate launching the caisson in shoal water a temporary water-tight bottom was built; in launching, this bottom leaked, and compressed-air was used to keep out the water. When launched, the caisson was moored alongside the Government pier, and three sections of cylinder plates put on by means of a boom-derrick, which was secured to the air-shaft and the roof of the caisson. The lowest section was securely bolted to the woodwork below, and the joint caulked with oakum. The joints between the plates, which had been accurately planed, were coated with red lead before being bolted together. About 9 inches of concrete were then placed on top of the caisson to depress the centre of gravity. The displacement was then about 400 tons, and the draught was 15½ feet; the caisson was then towed by two tugs, in six hours, to the site, distant nearly 20 miles.

The contractors had chartered the hulk of the old steamer "*Moro Castle*," and had moored it at the site by 6 anchors; this vessel was 200 feet long, 30 feet beam, and drew 14 feet of water; 80 tons of coal, 600 barrels of cement, 3 sections of cylinder plates, and the sections of the air-shaft were stowed below deck. The deck carried all the machinery, sand, broken-stone, timber, and kitchen and quarters for the officers and men. A boom-derrick, with a reach of 30 feet and lifting 2 tons, was secured amidships.

The following is a list of the machinery on board:

1. A locomotive boiler, with 18 square feet of grate and 400 square feet of heating-surface, and carrying 60 pounds pressure: this proved too small.
2. A feed-pump, connecting with the hot-well of the surface-condenser, with the fresh-water tanks and with the sea.
3. A surface-condenser, connected with all the engines and pumps.
4. A 2-cylinder hoisting-engine, with cylinders 6½ inches in diameter and 9 inches stroke: the diameter of the rope-drum was 16 inches, and was geared to the engine in the ratio of 1 to 5.
5. A Delamater air-compressor, having 2 steam-cylinders of 8 inches diameter, and air-cylinders, 10 inches diameter and 16 inches stroke. A maximum velocity of 120 revolutions per minute was required to blow the sand out of the caisson.
6. A Clayton air-compressor of the same capacity as the one above named; this was used to relieve the other while under repair. Both compressors were provided with water-jackets around their cylinders. The air was forced through water in a cylindrical cooler 2 feet 9 inches in diameter and 5 feet 4 inches high, and through a 2½-inch rubber-hose, to the upper end of the air-shaft. Gauges on the cooler indicated the water-level in it and the air-pressure. There was a check-valve also where the air entered the shaft. The air in the air-lock and in the upper part of the shaft became intensely hot, because no provision had been made for circulating water through the cooler; the workmen suffered considerably on this account.
7. A portable centrifugal pump, with 4-inch suction and discharge, and connected to the boiler and surface-condenser with hose. This pump was used as a bilge pump.
8. A duplicate of the above was used to furnish water for mixing concrete.
9. An air-lock large enough to admit 4 men at one time; it was made of boiler-iron, and had a cast-iron cylinder supply-lock of one cubic yard's capacity.

After the caisson was moored at the site it was quickly sunk by letting water into the cylinder through 6-inch valves. This water was partly replaced by broken stones as the latter were supplied by the schooner, and when the weight became sufficient the water was pumped out by the centrifugal pump, and the broken stone in the cylinder was made into concrete.

On July 17 the regular mixing of concrete was commenced; this work was done either on the hulk or on the schooners that brought the broken stones: on July 23, when the weight of the structure was about 500 tons greater than that of the displacement, the air-lock was bolted to the air-shaft, connections were made with the compressor, and the water was forced from the shaft and working-chamber.

The current produced a considerable scour as soon as the caisson was grounded; this continued until the caisson had sunk about 8 feet, and until its roof rested upon a mound of sand. The cutting edge of the caisson did not rest upon the shoal for a considerable part of its length, and at times the cylinder was 12° out of plumb; the scour was 10 feet deep near the caisson, and extended over an area of 70 feet in diameter. It will be noticed that the action of this cylinder was almost identical with the one sunk in the "Rothersand."

The working party in the caisson consisted of three gangs of eight men each, each gang working for eight hours, with a rest for meals after four hours work; they carried paraffine candles in their hats to light them at their work.

The sand was collected at the bottom and blown by the air-pressure through a 4-inch wrought-iron pipe which connected the working-chamber with the outside air, and which was provided with two cocks, one in the chamber, the other on the outside of the shaft. The sudden diminution of the air-pressure when blowing out the sand caused such a condensation of the moisture in the air in the working chamber as to make it so foggy that the men could see but 2 or 3 feet, and the blowing had to be limited to a half or a quarter of a minute's duration at a time.

The blow-pipe was at first made with a bend to throw the sand into the sea. This caused the pipe to choke and occasioned much delay. Afterward the sand was blown out vertically and either fell into the sea, the cylinder, or the hulk, where it did much damage to the machinery. This was remedied later by stretching a stout canvas over the pipe.

Sinking was continued at the rate of from 1 to 2 feet a day until July 31, when the cutting edge of the caisson had penetrated 18 feet and when the door of the air-lock was nearly at the level of high tide. The air was then allowed to escape, the shaft extended, the air-lock replaced, and the concrete increased to a depth of 37½ feet. The water was then forced out of the working-chamber, and on August 18 the work of sinking was resumed, and by the 28th, the cutting edge had reached the required depth, viz., 33 feet 4 inches

[1] Continued from page 242, No. 621.

below the original surface of the shoal. The kind of material penetrated changed at the level of 29 feet, the remaining 4 feet being clean, coarse, sharp, yellow sand mixed with considerable coarse gravel.

The resistance to sinking was so great during the latter part of the time that it was found necessary to diminish the air-pressure suddenly in order to facilitate the descent. The men remained in the working-chamber at these times.

The cutting edges were then tightly under-rammed, the working-chamber and air-shaft packed with sand, and the latter sealed with concrete at a level of 30 feet 4 inches above the caisson roof. The air-shaft was then taken off at a height of 38 feet 7 inches above the caisson, and the remainder of the 2,000 cubic yards of concrete were put in place, raising the concrete to a level of 13 feet 11 inches below the upper edge of the cylinder. The contractors, after erecting a mast from which the crew of the Fourteen-Foot Bank Light-ship were to show a lantern at night, left the site on September 16. Three foremen, two engineers, two firemen, thirty laborers and one cook were employed on the work.

At one time a rather curious accident occurred. During a heavy blow from the southward, the old hulk parted her moorings and commenced drifting directly toward the cylinder, which was then 8 or 10 feet above the water, but only filled with concrete to the water-level. Several of the men immediately jumped on the cylinder, and, sitting



"Bug" Light, Boston Harbor.

on the upper flange, which was about 6 inches wide, dropped fenders between the cylinder and the sides of the hulk to soften the blow. The hulk came against the cylinder so as to give it a glancing blow or push and then sheered off. The men essayed to jump on board, but to their astonishment several were unable to do so. When the hulk struck, she forced open the joints between the plates of the cylinder, which, immediately closing when relieved from the pressure, caught and securely anchored the men by the seats of their breeches. The involuntary prisoners had to decide promptly, for their home was drifting from them, so they, with one accord, gave one *arrière pensée*, tore their trowsers and jumped on board.

The bids received for finishing the cellar story in accordance with the approved plan not being reasonable in amount, the Board decided to build a temporary frame house of two rooms and a platform, from which to show a fourth-order light, until the work on the superstructure should begin during the following season. This light was first shown on October 24, and during the winter was maintained by two men employed as temporary keepers. It proved of much value to navigation, as its range and visibility were greater than those of the adjacent light-ship, which besides in winter was necessarily off her station.

One thousand tons of rip-rap were placed around the cylinder to prevent any additional scour. Soundings made the following March showed no change in the shoal around the pier; an unequal settlement of one inch had taken place during the winter. Brush mattresses were not used here; they would not only have been costly, but they would also have prevented the stone from sinking through the sand, and thus holding the pier securely in place.

During the winter plans were prepared for the superstructure under the direction of Major Heap. This superstructure consists of a two-story cast-iron dwelling, surmounted by a fourth-order lantern, secured to a cast-iron gallery floor, supported by iron columns and girders and brick arches and walls, resting upon the concrete filling of the pier.

The cellar story is arranged for a Daboll trumpet and duplicate hot-air Ericsson engines, cast-iron water-tanks, brick compartments for fuel, provisions and oil, the latter having iron doors and ventilators so arranged as to close automatically in case of a fire and thus smother the conflagration.

It was found that the structure trembled somewhat from the shock of the waves, so 2,000 additional tons of rip-rap were placed around it to increase its stability.

This Light Station was entirely completed in the spring of 1887. Its entire cost, including examination of site, experimental work, rip-rap, lens, fog-signal, superintendence and contingencies of every nature, amounted to $123,811.45, more than $50,000 less than the sum appropriated.

A red sector indicates the location of the Joe Flogger shoal; this sector, combined with red sectors of Cross Ledge Light, clearly defines the main channel as far as the Ship John shoal light. Another red sector marks the Brown shoal, it is to the south of the Brandywine shoal light, and materially assists the navigation of the lower bay.

Cast-iron cylinders filled with concrete have also been successfully used on rocks nearly awash and on sub-marine sites in shallow water where the foundation was stable; they are less costly and in some respects superior to masonry piers, as they are easily and quickly placed in position, and they have no joints into which water can penetrate and freeze, thus forcing out the mortar, as is the case with piers built of stone. Their circular form also simplifies their construction and adapts itself perfectly to a circular tower.

The sketches show several light-houses of this type; the towers are also of cast-iron lined with brick; they are three stories high exclusive of the cellar and contain all the necessary room for the accommodation of two keepers.

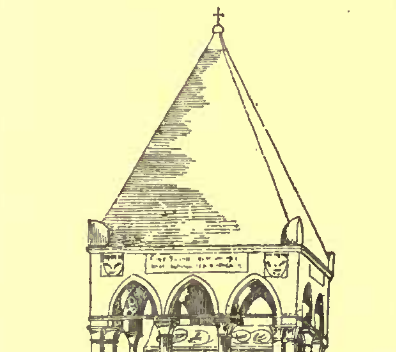
The Stamford light rests on the south-west extremity of Harbor Ledge in Stamford Harbor, Conn.; the pile pier shown in the sketch is a temporary structure used in the construction of the light.

The Whale Rock light is on a rock at the entrance to Narragansett Bay, Rhode Island; the sea is frequently so violent here as to throw solid water as high as the top of the pier, while the spray flies entirely over the tower.

The one at Sharp's Island, Md., is in the much quieter waters of Chesapeake Bay and rests on sand, the scour being prevented by rip-rap.

One great advantage of this type of foundation over screw-pile structures is that the former can successfully resist the impact of ice.

THE ACOUSTICS OF BUILDINGS.

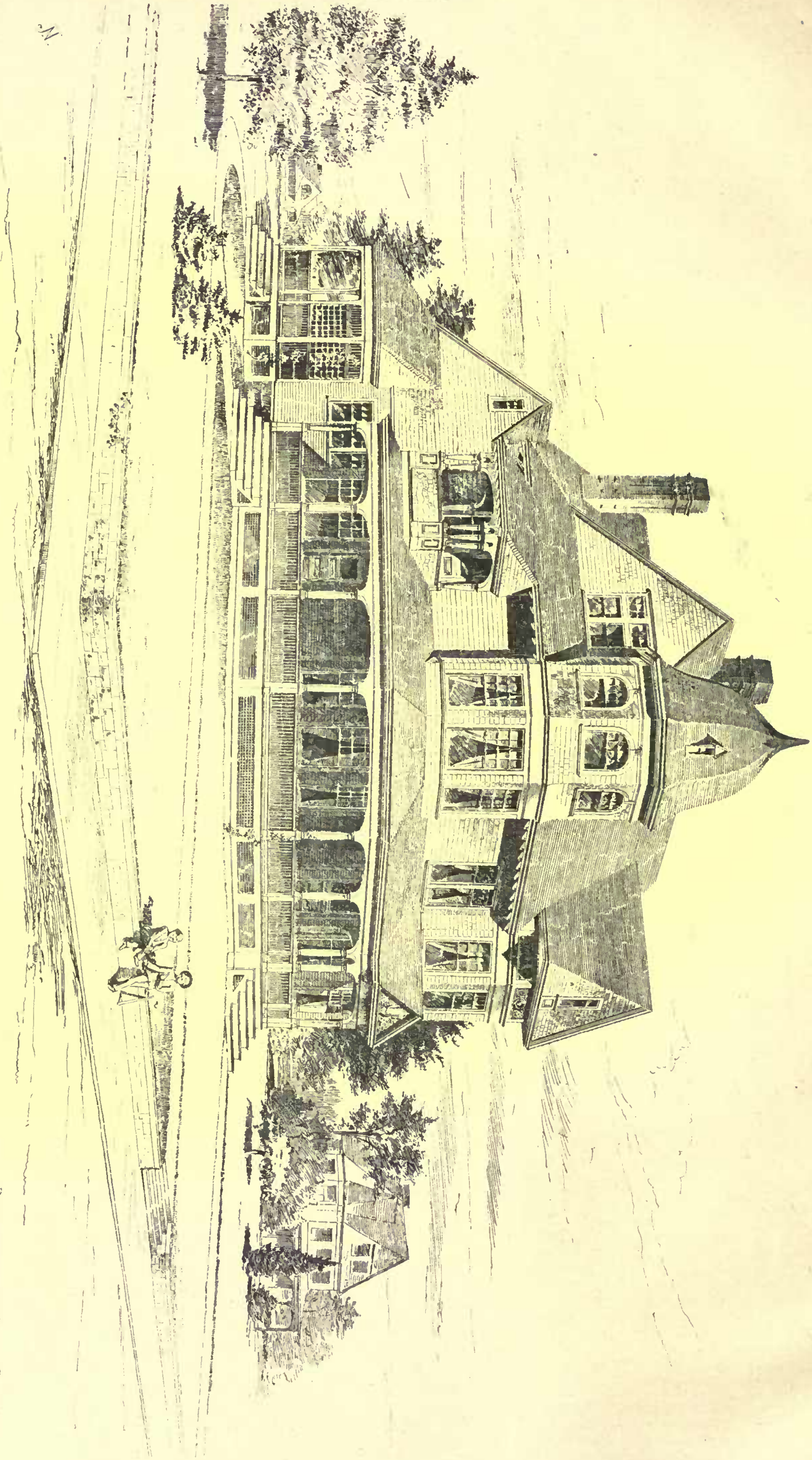


TOMB OF THE PASSAGERI, BOLOGNA.

THAT buildings intended for public speaking occasionally prove to be ill adapted to the purpose for which they were erected is probably due to the impression that it is a matter of mere accident what acoustic properties they will possess. The Rev. C. H. Spurgeon gave utterance to this belief when his Tabernacle was in course of erection, and when some of the committee objected to certain proposals of the architect, in this regard, he said: "I don't believe that any of us know anything about it," adding, "but if we let the architect have his own way, we shall have the small consolation of blaming him in case of a failure." Some few years before that date the same architect had erected a building that proved to be unsatisfactory in these respects, but he observed that a widely-experienced orator with a voice well-nigh as powerful as an organ, was heard with perfect distinctness, whilst ordinary speakers were heard with some difficulty. He consequently came to the conclusion that the practised ear of the orator had led him instinctively to adapt the strength of his voice to the dimensions of the building, which was but of moderate size. He subsequently made a series of experiments upon this building, and adopted some remedial measures, and from the whole deduced principles upon which he has since acted with success, it may be concluded, inasmuch as no complaint has reached him in reference to some scores of similar buildings he has since erected, and moreover, by the application of these same principles, he has cured, more or less completely, several halls, etc., constructed by others.

It requires but little acquaintance with science to accept the fact that sounds are nothing more than vibrations of the air. These, as varied and modulated by the human voice, constitute the several syllables and words that are comprised under the term "speech." It is not enough that the hearer can tell that the speaker is uttering

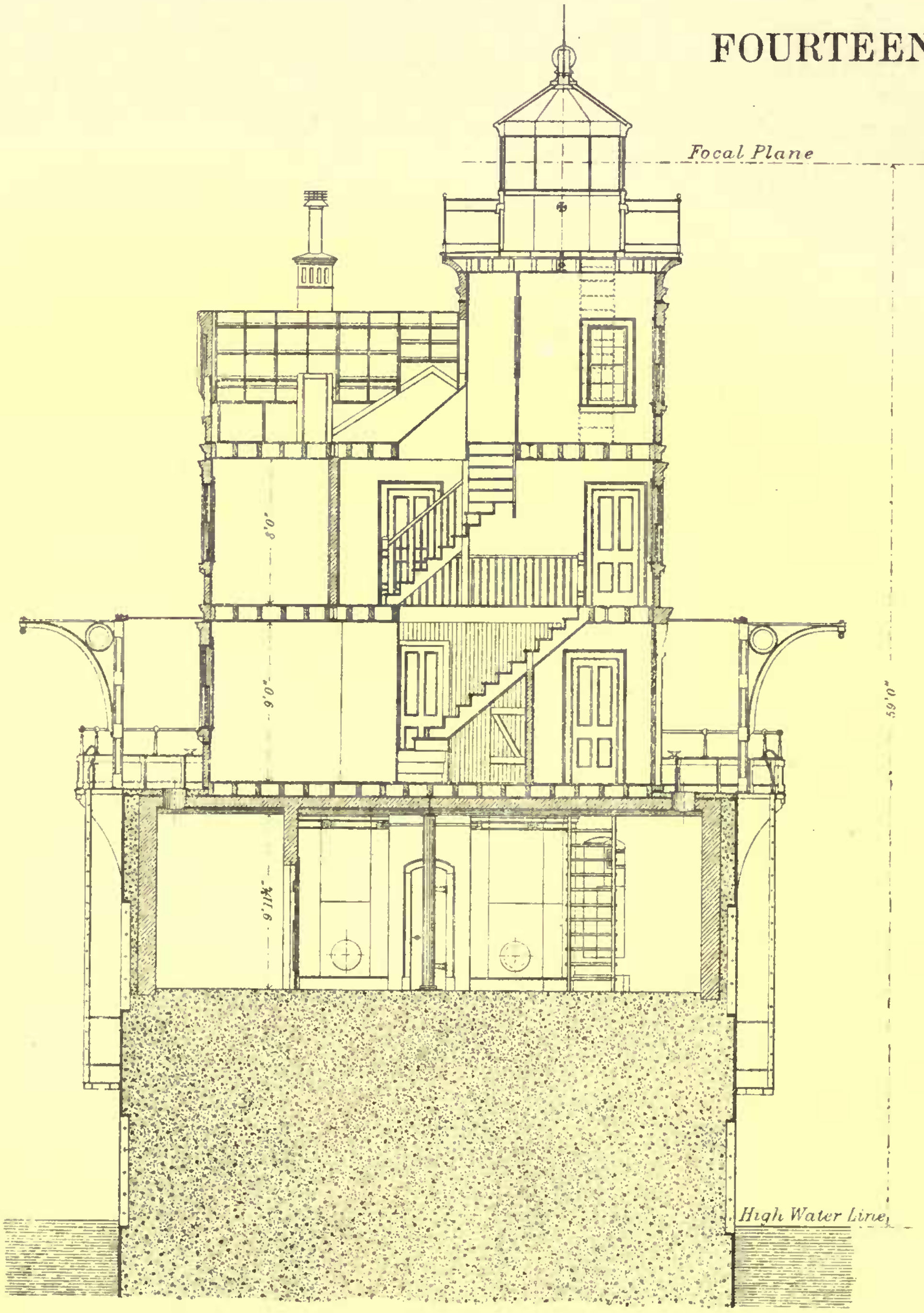
Joseph W. Northrop Archt.
Bridgeport Conn.



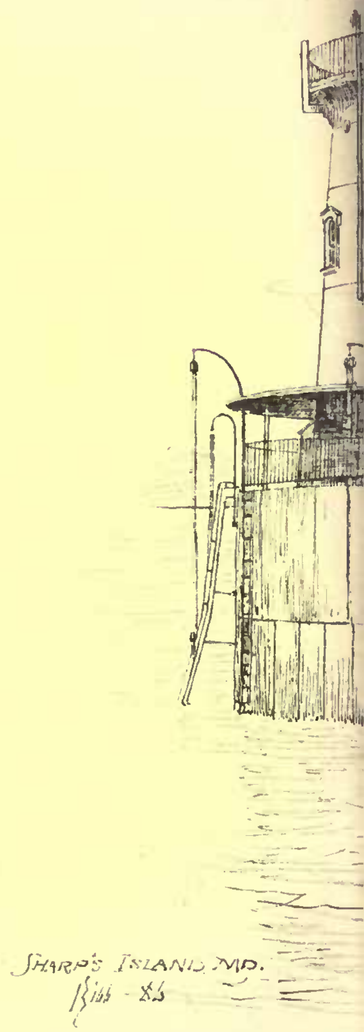
Residence of Chas. G. Downs
Bridgeport Conn.

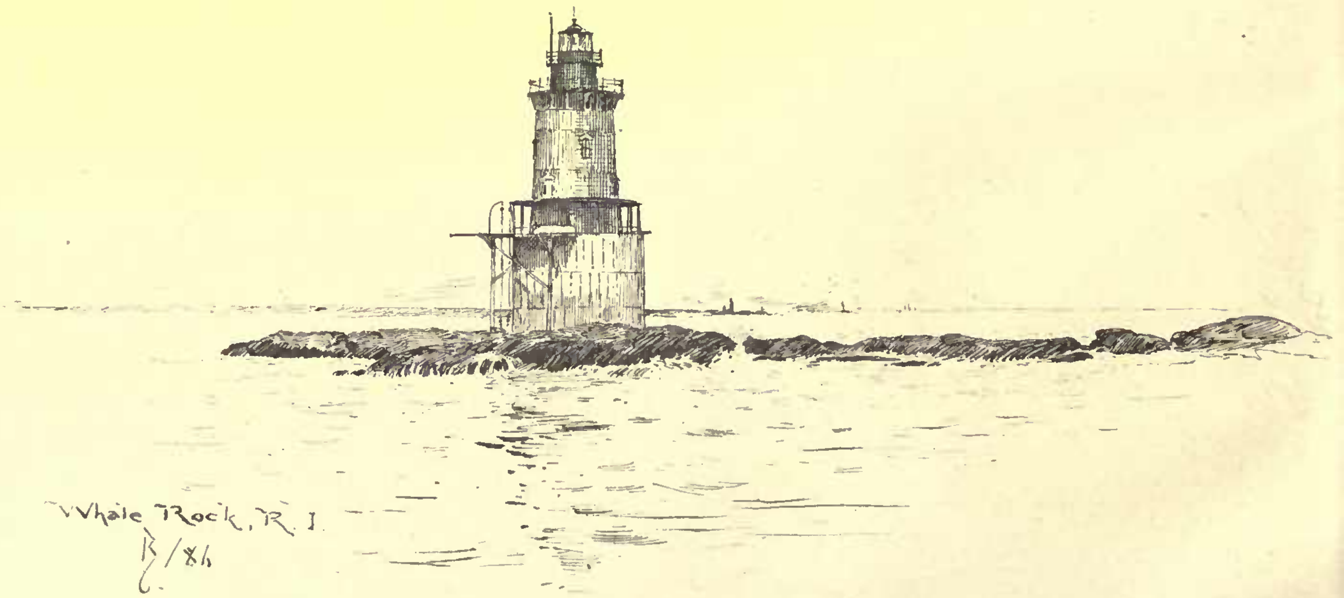
Heliotype Printing Co. Boston

FOURTEEN-FOOT BANK L

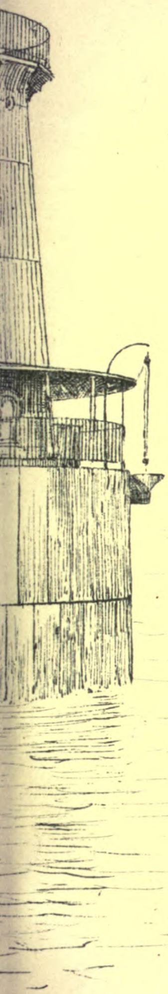


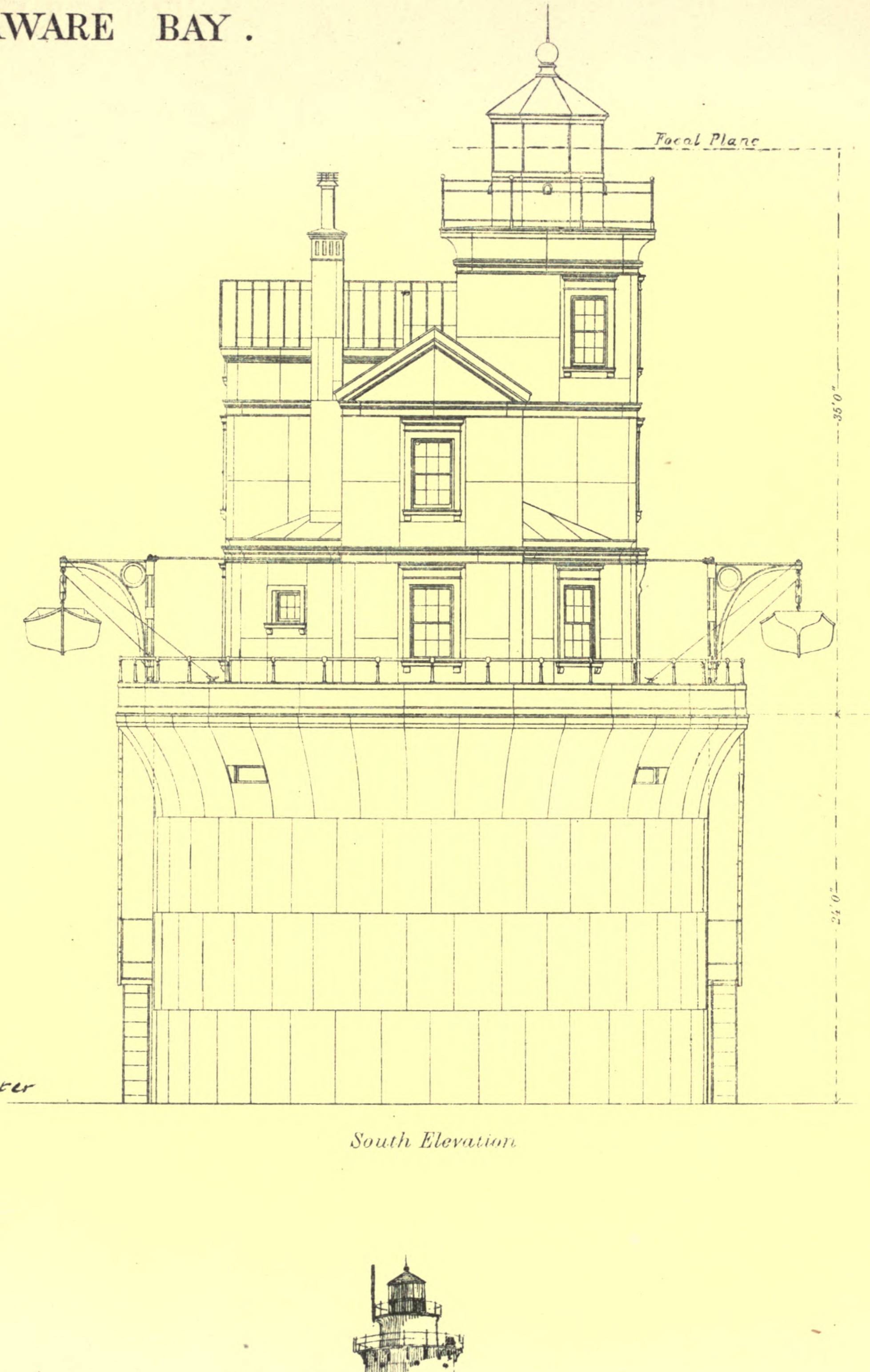
Sectional Elevation





-STATION, DELAWARE BAY.





South Elevation



Stamford Harbor.



ALDERSHOTT GRAND HOTEL
· GEO · EDWARDS : ARCH ·



· COLONIAL & U·S·
· MORTGAGE Co. HULL ·
· R CLAMP , ARCH :



· BUSINESS - PREMISES
· MAYFAR · Eng.
· WIMPERIS , ARCH ·

Heliotype Printing Co Boston.

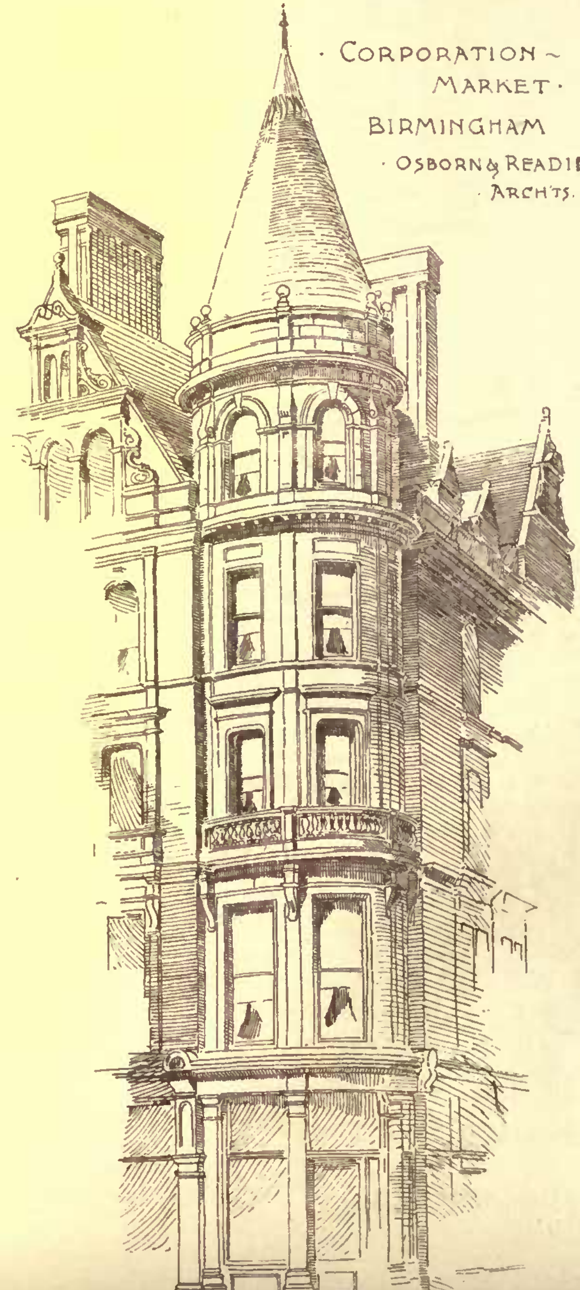
American Architect and Building News, Dec. 31 1887.
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NORTHERN ASSURANCE Co: DUNDEE, ENG. James Maclaren & Son Arch'ts.



SAVINGS BANK SCOTLAND ROAD. LIVERPOOL. G·E·CRAYSON, ARCH.



· CORPORATION ~ MARKET · BIRMINGHAM · OSBORN & READING · ARCH'TS.

The Treatment of


Wm. S. Eames
and
Thos. C. Young
Architects
St. Louis
DWELLING
FOR
C. D. McLURE
Esq.

sounds; these must come to him so separate and distinct that he may at once recognize them without hesitation or effort. It is not so in concerted music, where only the general effect is of importance, but in speaking, each word and each syllable must have its own independent and sharply-distinctive inflection, resulting from a wonderfully minute and delicate variation in the form or rapidity of the vibrations, commonly called waves of sound.

Misled by what the eye sees, we are apt to assume that the waves of the sea are merely agitations of the surface, and, transferring this impression to our present subject, we may need to remind ourselves that sound-waves are *spheroidal* oscillations of the atmosphere, originated at one point, but spreading out in all directions — much, perhaps, in the form that would be generated by an ellipse revolving on its major axis, the originating cause being assumed to be in or near one of the foci, each successive oscillation increasing in area, but losing in energy in the same proportion, till it becomes too feeble to set the delicate structure of the inner ear in motion. How minute these oscillations must be is illustrated by the fact that, though not nearly so rapid in motion as those of light, they may, in a clear atmosphere, be projected more than a thousand feet in a direct line in a second of time, and yet they have no power to visibly move the lightest gossamer. Still, we know by experience (in a whispering-gallery, for instance), that the scientific theory of the equation of the angle of impact and reflection is a practical reality. It results that any obstruction interfering with the correct development of any such oscillation deprives it, more or less, of the power of producing a successor, or, on the other hand, may originate a series of reflex waves, which, mingling with those resulting from subsequent utterances, shall so impede their action as to destroy the distinctness of the sound. In order that the oscillations may be freely propagated, there must be free space occupied only by the atmosphere, or, on the side where this is wanting, the progress will be retarded or destroyed. Hence it is said that sound ascends, the floor or audience distorting the wave, retarding its progress, and so enfeebling it on that side; from the same cause it results that a room, "bad for hearing," is worse when empty. In the same way the flat ceiling of a low room, or the walls of a very narrow one, will act as preventatives to the transmission of the voice.

It may also be remarked that as the oscillations increase in area, that is, in distance from the speaker, any arc of them approaches more and more nearly to a plane surface, and if this arc strike a plane surface at right angles, it does so more *aplomb* than it would if it were more rounded, and consequently is thrown back with greater force, and under certain circumstances with sufficient power to destroy, or greatly to interfere with, the succeeding sounds. Sir C. Wren considered the limits for a "moderate voice" to be fifty feet in front of the speaker, thirty feet on either side, and twenty feet behind him, provided he did not drop the last word. Probably Wren's conclusions were based upon experiences in open apartments without obstructions, for in such these will be about the limits. When, however, a length of one hundred feet, with corresponding width and height is reached, a "moderate voice" will not fall on any surface with sufficient force to create a mischievous rebound. If the apartment is rectangular, with solid walls, and, say, between fifty feet and one hundred feet in length, some device will be needed to prevent an echo.

From these remarks it would seem that in all ordinary cases the difficulty does not arise from inability to fill the place with the voice, but from the rebound or echo created by the wall or surface opposite to the speaker. In the Metropolitan Tabernacle, fair average voices have been distinctly heard at a distance of one hundred and thirty feet, and large places such as Exeter Hall and the Free Trade Hall (Manchester) are not those that are "bad for hearing." Guided by these principles, the parts of a building in which the speakers could and could not be heard have been repeatedly pointed out and the defect either completely cured or sufficiently modified. In a town-hall in Hampshire, useless for speaking, as large a portion as possible of the end wall was cut out, so as to form a deep recess, which was filled with seats and lined with matched boarding; a shallow gallery or balcony was also introduced around part of the hall, with the result that this hall was perfectly cured when the gasaliers were lighted, though the success was not quite so complete without them. In the case of another public hall, which could not be let, so bad was it for sound, open drapery was introduced across it at a spot suggested by the form of the hall, and here the town council intimated their surprise at the success of the experiment. In Carpenters' Hall, London, two columns and a small gallery (ostensibly for musicians) are advanced about six feet from the wall opposite the chair, with the result that this room is generally considered an acoustic success. These cases are mentioned as indications of methods that have been adopted and which can be recommended. Where the building is more complex, other difficulties have to grappled with. In a church with too long and narrow transepts, it was found that these transepts set up echoes of their own and so disturbed the whole congregation. As the ripple on the water, in passing through a confined aperture into an open space, will set up a fresh system of ripples, so, in like manner will sound, and a rebound may, as in this case, be the result.

In some instances it may be desirable to prevent the echo by enfeebling the oscillations through distortion. If the section of the apartment approach the form of a segment of a circle, the centre of which is, perhaps, ten to twenty feet above the speaker's head, the sound-wave has free scope for travelling. But if a flat ceiling at the mean of the original height were introduced, the power of the sound-wave would be proportionately impaired, without its efficiency within moderate limits being destroyed. On the same principle, any large projection from the sides, or the contraction of the width of the apartment may impede the reproduction of oscillations, and so tend to prevent their being thrown back from any large opposing surface. Of course, another obvious resource is that of covering with a non-elastic material, such as tapestry, any surface from which it may be apprehended that an echo will be produced.

If the above principles are sound, it will be obvious that (except, perhaps, in *very* large buildings) parabolic sounding-boards or other contrivances for throwing forward the voice must, so far as they succeed in so doing, increase rather than diminish any acoustic difficulty that exists. — *Wm. Willmer Pocock, in the R. I. B. A. Journal.*

THE ILLUSTRATIONS

[*Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.*]

THE TOWER OF TRINITY CHURCH, BOSTON, MASS. MESSRS. GAMBRILL & RICHARDSON, ARCHITECTS.

(Gelatine Plate, issued only with the Imperia and Gelatine Editions.)

THE negative from which this plate is printed was taken with the intention of including the view in the "*Monograph of Trinity Church*" just published, but various reasons induced us to reject it in favor of other views. As the view and negative are too good to be wasted, however, it is published here.

ROOM NO. 4, SOUTH QUAY, GREAT YARMOUTH, ENGLAND. MEASURED AND DRAWN BY MR. C. J. BROOKE.

[Issued only with the Imperial Edition.]

THE companion drawings of this set were published in the *American Architect* for October 22 last.

HOUSE OF CHARLES G. DOWNS, ESQ., BRIDGEPORT, CONN. MR. J. W. NORTHUP, ARCHITECT, BRIDGEPORT, CONN.

THE TREATMENT OF ROUNDED CORNERS — I.

ONE of the difficulties of architectural designing is to determine how to treat a rounded corner above the main cornice line. Upon this sheet will be found a number of solutions to which others will be added from time to time.

FOURTEEN-FOOT BANK LIGHT-HOUSE, DELAWARE BAY, U. S. A.

For description see article on "Ancient and Modern Light-Houses," elsewhere in this issue.

HOUSE FOR C. D. MCLURE, ESQ., ST. LOUIS, MO. MESSRS. EAMES & YOUNG, ARCHITECTS, ST. LOUIS, MO.

THIS house is built of split-face red granite and ten-inch brick. Interior richly finished in Georgia pine, cherry, oak and white mahogany; cost, about $40,000. The frame building is covered with shingles, stained, and cost about $6,000.

NOTES OF TRAVEL.

CHICAGO. — II.[1]



AFTER L'ART
IVORY COFFER. XIV CENT.

CHICAGO'S pride is in her office-buildings, and no one can deny her the full right to every possible feeling of admiration for the creations which, during the past ten years have sprung up within the business portions of the city — edifices which are thoroughly modern in their spirit, meeting fully the requirements of the business life of to-day and at the same time are treated in a manner not only reflecting great credit upon the profession for what has been achieved, but evincing a spirit that reasonably leads us to expect still better things in the future. The office-buildings of Chicago are purely creations of the present decade. Not that such structures were unknown to the Chicago of twenty years ago, but the buildings as they now are, planned and conceived as we find them in this great Western city, are so largely original in their entire thought that, while it is easy to trace the lines of development that have led to them, no one will deny their originality in architectural treatment. Chicago may justly feel an additional pride in that they

[1] Continued from No. 626, page 300.

are purely the results of local genius. With one or two exceptions, none of the large buildings in Chicago have been erected by outside architects, and we believe the fact is pretty well substantiated that most of the large buildings have been erected as well by Chicago capital, so that they in every respect represent a phase of Chicago art. As such, they should be studied on the spot, for, however vivid a description may be given of such structures, they must be seen to be appreciated, and no pictures can fitly portray them. In this latter respect we will say that it must be remembered the buildings are very high and the streets relatively very narrow, so that it is almost impossible to get good views or fair sketches of any of the work.

In considering the more typical of the Chicago office-buildings, it may be well to give a little notice to what preceded these large structures. Chicago has always had large buildings in its mercantile streets. From the very beginning, the business was centred in one locality and it grew from a common focus, so that there has never been any mixing of the residences and the business-houses to the extent found in many other cities, and there has consequently been a well-defined growth in large buildings. The great fire of 1871 swept away the entire business portion of the city. From a commercial point of view it was a great calamity, especially when we consider that of all the firms that were burned out by the fire, hardly one which attempted to pay cash was enabled to keep itself intact for more than a few years. From an artistic point of view, however, the fire was a good thing for the city. It left the way clear for new growth, and, although from the very fact of the path being so open, a great many buildings sprang up which were meretricious in style, still the fact of so many large structures being under way at once aroused the public mind and stimulated the art impulses of the local architects, and these conditions, together with the strongly-felt influence of the Centennial Exhibition, prepared the way for the architectural triumphs which have since been such a credit to the city. Perhaps it is not entirely fair to other portions of the country to describe these buildings as exemplifying a peculiarly new style, for, aside from the question as to whether there is anything new nowadays in architectural thought, it may reasonably be asked whether the Chicago structures show any more originality than is found elsewhere, but certainly the changes have been at least towards new methods and better and larger arrangements.

Changes have come in the planning of the interiors of the buildings as well as in the designs of the exteriors. Twenty years ago, yes, even less, there was not a building in Chicago which was really "planned" in the sense the expression would be understood by one of the active architects of to-day. There was very little system in the arrangements. The rooms were invariably on two sides of a central corridor with a stairway at one end. Sometimes the corridor was parallel with the street and sometimes it ran back at right angles, but the result was always the same — dark, unwholesome corridors, steep, misplaced stairs, and rooms which were too high and too poorly lighted to be of the best use. There is one feature in the Chicago street-system which should be considered in this connection, as it is to a certain extent peculiar to the city. The entire city is laid out with narrow alleys, intersecting each block and dividing it into four portions. Of course, such alleys exist in all cities, but in Chicago they are the rule. By this means the problems of planning and building with reference to light and air become very much simplified. The light is obtained from the rear and the front in all buildings, and eight buildings in each block can have side light as well. Besides, the blocks are all rather small in the business portions, rarely over four hundred feet long, and more often much less, hence, schemes for interior wells and open areas, which are necessary devices in Boston or New York, are never dreamed of in Chicago, and very little attention seems to be paid to such subjects. Hence, it will be understood that some of the old buildings must have been very dark, for, after all, though an alley in the centre of a block sounds very open and light, it does not afford a great deal of illumination to the lower stories of a high building.

The Chicago architects, in their attempt to solve the problems involved in the arrangement of a large office-building, have not been at all backward in trying new schemes. It might almost be said that every possible arrangement of a large office-building can be studied in Chicago. There are at least six distinct types of buildings, in respect to the disposition of plan. The first arrangement, and perhaps the most common, is that adopted for the Opera-House Building at the corner of Washington and Clark Streets, the architects of which were Messrs. Cobb & Frost. This was erected only a few years since and is still practically a new building. It occupies a wide frontage on both streets. The plan consists of two wings, one along each street, with a corridor down the centre and offices on either side. Light is obtained for the corridors by windows at the end and also at the elevators, which are placed in the centre of the Clark Street front, occupying an enlargement of the hall, extending across the entire breadth of the wing. The dark corner at the inner angle of the building is occupied by the stairs, which are continued beyond the inner line of the Washington Street wing so as to permit of a window at the corner. On the ground-floor the building occupies a rectangle equal to the two fronts, the inner space being taken up by the Opera Hall. As it is a very high building and rises considerably above those behind and on each side of it, the rear offices are quite as light as those on the front, and should the buildings be built up on each side to the same height as the Opera-House Building, the rear offices would still be very good, as the building is so large that the space occupied below by the auditorium is equivalent to a very wide open area above. This plan has been adopted in a number of the buildings at the corners of two streets.

Another scheme which we believe has never been tried elsewhere in Chicago, was carried out in a building on Monroe Street, near Franklin, erected by Messrs. Burnham & Root. In this case, the building occupies an entire rectangle. The centre of the building is open from the ground-floor to the roof, and surrounded with open galleries at each floor level. The stairs ascend from the ground-floor in this interior court and are carried up on each side. We believe that there is but a single tier of offices facing outward from this interior well. The plan is hardly a success, besides being very difficult to treat architecturally. The large well seems to imply a waste of room, though it is not necessarily so, and the effect given by the interior is rather that of an experiment which it would not do to copy.

A third type of building is that of the Montauk Block on Monroe Street, erected by Messrs. Burnham & Root. In this the plan somewhat suggests that of the Opera-House Building, except that the rooms are very much more compact, and there is but a single central hall, the rooms opening upon it from three sides and a part of the fourth, the remaining corner, away from the street, being occupied by the stairway, while the elevators are near the front of the building and are quite dark except for what transmitted light they obtain from the stair-well. The building is entered from the centre. The offices are, in the main, well arranged, and, being grouped so closely about the central hall, are easily accessible, and can also be readily thrown into suites.

One of the best-arranged of the office-buildings in Chicago is the Home Life-Insurance Building, built by W. L. B. Jenney. The structure occupies a rectangle without any large wells or interior court-yards. It is built on a corner and consequently has light on two sides. The entrance is in the middle of the long front. A broad flight of stairs leads directly to the first floor and to the elevators, which are well lighted and are not enclosed except by light ironwork, not sufficient to materially obstruct the light. The stairs to the upper stories are arranged in the inner corner at the left. The halls and all the offices are perfectly lighted, and there is not a dark corner in the building, while at the same time the offices seem to be conveniently arranged and the corridors are reduced to the least size possible.

So far as we can remember, there are but two instances in Chicago of an open well towards the street, such as was adopted in New York for the Mills Building and in a few other cases throughout the country. The first instance is the Pullman Building, a structure which, in as far as relates to the corridors and stairs, is quite well planned, though possibly the credit thereof is not entirely due to the architect, Mr. Beman, as the arrangement is practically the same as in the Mills Building in New York: the Pullman Building is better, however, in that the entrance-hall is not so deep nor the well so deeply recessed, and consequently the stairs and elevator-wells and the offices fronting on the well receive a greater proportion of light and are much pleasanter in every way. There are a number of clever devices in this building for getting light into the lower halls and basement, which reflect great credit on the architect, and the appearance of the hall-way in the first story is certainly very pleasing. Still the plan does not appear to have been really adopted in Chicago, if we may judge by its lack of followers. The other example is in the Rialto Building by Burnham & Root.

The latest expression of planning is embodied in the Rookery Building, a huge structure occupying the corner of La Salle and Adams Streets and extending to the alleys each way. It has been but recently completed from the plans of Burnham & Root. We believe this is the largest office-building in Chicago, and we should not be surprised to know that it is the largest of its kind in the United States. On the ground-plan it measures outside about 168 x 180, and is eleven stories in height, including the basement. The plan is in some respects rather peculiar. The main entrance is on La Salle Street, opening into a wide vestibule, from which stairs start up on either side, turning around and meeting on a landing towards the interior. The corridor continues on under the stair-landing and passes by the elevators, of which there are three on each side, emerging into an interior court about 62 by 72 feet in unobstructed dimensions. This court is roofed-in at the level of the second floor, and from the ground-floor a flight of steps is carried up towards the side opposite the entrance of the building, landing on a gallery which encircles the court at the first floor level. So far the plan is very straightforward, and things are arranged in a symmetrical manner, which would please the most captious critic; but the difficulty begins with the flight of stairs just described. They start from the middle of the court-yard, and are very grand and monumental in conception and detail, but, unfortunately, they lead to nothing, simply landing in the gallery opposite a wall, which would be quite blank except for a recessed bay, the only apparent reason for the recess being to give something which shall seem to create a purpose for the stairs landing as they do. One would naturally expect the stairs leading to the stories above to continue from opposite the large first flight of stairs. On the contrary, they do not, but start up from the opposite side of the court-yard towards the street, being projected from the balcony into the space above the court-yard and carried up on a curve to the floor above, from whence they continue to the upper stories in a semi-circle corresponding in width to

the space between the elevators. The La Salle Street entrance, and the stairs and elevators just described, are supplemented by another similar entrance towards the end of the Adams Street, but on a lesser scale. The arrangement is much the same; entering into a vestibule, the stairs start up on each side and meet above, the corridor passing through beneath. Here, however, there are five elevators in a line directly opposite and facing the entrance, and the stairs to the upper stories ascend behind the elevators and on a line parallel to the Adams Street front.

The office division of the first story is purely arbitrary, and is made according to the wants of the parties taking the rooms, being mainly divided into large brokerage or banking establishments. The real planning occurs in the upper stories. The arrangement consists of a continuous corridor carried entirely around the building, so as to give a double tier of offices on all sides, towards both the streets and the alleys. The inner offices facing the well are made 18 feet deep, while those of the outer tier towards the streets are 22 to 24 feet deep. The corridor is eight feet wide and is unbroken, the stairs from the La Salle Street front being carried in from behind the elevators. The elevators towards Adams Street open directly on the hall, the elevator-screens forming one side of the passage. The elevators towards La Salle Street open on the lobby corresponding to the width of the entrance hall in the first story, being nearly 18 feet across. The dark corners of the interior of the building are taken up in each case by vaults, which are arranged in stacks and divided into compartments and let out to tenants, two vaults in each stack opening into offices and the others into the corridors. The construction of the walls about the interior well is entirely of iron, with a terra-cotta covering permitting it to be very light and open, so that really the offices toward the court are quite desirable, and are very airy and light. It should be noted that the well is entirely open to the sky, there being simply a skylight above the first story.

The cellar space under the building or under the court, is very fully utilized by the large safety-deposit vault of a Trust Company. A certain amount of light is obtained through the floor of the court, which is paved in glass, but, of course, such light is dim at the best, coming through two thicknesses of glass, and has to be supplemented by electric-lights.

Altogether the building presents in the plan the most comprehensive scheme that has yet been worked out in Chicago, and it certainly seems very satisfactory.[1] C. H. BLACKALL.

[To be continued.]

NOTES AND CLIPPINGS

THE SELF-SUFFICIENCY OF THE PARTLY EDUCATED. — Only those who have done some piece of intellectual work to be judged by many, officially entitled to sit in judgment upon it, but in no way qualified, know the full depths of human stupidity even in fairly-educated folk, and those who have had that sorrowful experience have seen such depths of human stupidity as would *a priori* have been thought incredible. The most frightful exhibitions of stupidity occur when men, not by any means stupid or illiterate, are called to judge of work which lies quite outside their experience and capacity. Likewise when men, of fair general information, try to pass themselves off as possessing knowledge which they do not possess. It was not a block-head, but a man of moderate learning and of very great smartness (and self-sufficiency), who seriously declared that he had never read either Shakespeare or Milton; and furthermore that he did not believe that anybody had ever read either Shakespeare or Milton. Having looked into "Hamlet" one evennig, and found that he was not interested, he concluded that he was a fair specimen of educated humanity, and that what did not interest him, could not interest anybody. Many men, fairly literate, have a rough impression that all intellectual work belongs so much to the same order, that if they can with a good result apply their understanding to one portion of it they may without absurdity apply their understanding to any portion of it. This is a curious illusion. A decent graduate of a Scotch university, who has studied for the kirk and done the duty of a parish for ten years, would never dream that he was therefore qualified to judge of the technicalities of Music, or of Architecture, or of Engineering, or of Golf. In such matters he would bow to the judgment of experts. I have, indeed, heard of a good Professor of Divinity who instructed Sir Gilbert Scott, near the end of his career, in the high principles of architecture, the Professor stating that he had evolved these from his inner consciousness in the light of the Divine. But after he had spoken at much length Sir Gilbert Scott smiled kindly and departed without even a syllable of reply. That Professor was, indeed, an exceptional man. Men not exceptional at all will, however, be found to express an authoritative opinion upon liturgies, upon hymnology, upon ritual, never having bestowed the smallest thought upon these, and that without any idea that this is presumptuous; that, too, though they are clever and sensible men. — *Longmans Magazine.*

THE MAKING OF AN ARCHITECT IN HIM. — Dawny Campbell went to build a small out-house of brick. After the usual fashion of bricklayers he wrought from the inside, and, having the material close beside him, the walls were rising fast when dinner-time arrived, and with it his son Jock, who brought his father's dinner. With honest pride in his eye Dawny looked at Jock over the wall on which he was engaged, and asked, "Hoo d'ye think I'm getting on?" "Famous, fether; but hoo dae ye get oot? ye've forgot the door." One look around him showed Dawny that his son was right; but, looking kindly at him, he said: "Man, Jock, you've got a gran' heid on ye; ye'll be an architect yet, as share's yer father's a mason." — *Glasgow Evening Times.*

THE PONTE SISTO, ROME. — You all remember the fine bridge, Ponte Sisto, over which your carriages rolled on Mondays and Fridays when you were in Rome. On those afternoons in fine weather it is the mode to mount the Janiculum hill and go to drive in the beautiful grounds of the Villa Pamphili Doria, where on soft warm February days we hunt up in the grass violets and anemones. We have always been told by the learned in such matters — Nibby and the like — that Ponte Sisto was originally built by Caracalla. As Caracalla's name was Marcus Aurelius Antoninus Caracalla, the bridge was called Aurelian, and also Janiculensis. That was in the third century, A. D., for Caracalla the Monster reigned A. D. 211–217. Nearly one hundred and fifty years after (A. D. 364), during reigns of the Emperors Valentinian and Valens, we are told, the bridge was rebuilt and called Ponte Valentinian. In the Middle Ages the bridge was broken and called Pons Fractus. The terrible inundation of A. D. 792, when the Tiber swept into Rome and carried the Flaminian gate to St. Marco, the Ponte Valentinian was ruined, and for centuries was impassable. When Sixtus IV. (Della Rovere, 1471–1484) was a monk comparatively unknown, he held the office of procuratore, or attorney, for the Conventuali order, and lived at the convent of San Salvatore in Onde, not far from Pons Fractus. As he had to go often to the Vatican on the business of his office, he was obliged to go around by Ponte St. Angelo, when it would have been much more convenient to have passed over Pons Fractus. One day he said jestingly: "When I am Pope I shall rebuild Pons Fractus." Neither he nor any one who knew him at that time ever dreamed of his occupying the chair of St. Peter, but time brings the most unlikely things to pass. Years rolled by and the poor procuratore Franciscan monk rose gradually up in the ecclesiastical ranks and became an important personage — general of the Minorites, then cardinal of St. Pietro in Vinculi. When Paul II died, in 1471, Cardinal della Rovere was elected his successor. Among the first works he put into the hands of his architect, Baccio Pintelli, was the rebuilding of Pons Fractus, not because his holiness remembered his inconvenience of preceding years, but because the great jubilee of 1475 was near at hand. The Pope wished to avoid the recurrence of the terrible catastrophe which took place at the preceding jubilee of Nicholas V, when the crowd was so great on Ponte St. Angelo that not only great numbers of people were crushed to death, but also many were pushed over into the river and drowned. Sixtus IV wished to provide another passage-way over the Tiber, so as to disperse or divide the crowd. The bridge was begun in 1473, opened to the public for the jubilee in 1475, and entirely completed in every part in 1477. Pintelli made a good, strong bridge. Four hundred and ten years it has been standing, and is still firm and good. You remember, of course, its four great arches of travertine. In the centre is a huge opening made by Pintelli to allow the waters of the river during an inundation to relieve themselves and to lessen the tremendous shock in the middle of the bridge. The common people of Rome call this opening "*l'occhialone di Ponte Sisto*" — the big eye of Ponte Sisto. It was a costly work even in those days, and there is a curious fact as to the procuring of the money for it, which gives us a strange idea of the public morals of that period. The courtesans of Rome, a large and wealthy class in those days, were made to pay for the whole cost of the bridge! That class of degraded women lived in great luxury, but they were never allowed to appear in public without a mantle of black and yellow. After the inundation of 1598 — a fearful one — Clement VIII (Aldobrandini) restored the parapets and pavements which were injured. — *A. H. Brewster in the Boston Herald.*

A HINT FOR INVENTORS. — They tell, says an American contemporary, a curious story of old Christopher Meyer, who was more or less with Ives. Many years ago he was a workman in a factory where rubber shoes were made. He received the fabulous sum of $1.25 a day. At night he worked out the details of an invention for economizing in the number of men employed in the factory. One day he finished his machine, carried it to the shop, and showed his boss how well it would do the work of a dozen or twenty men. The boss was thunderstruck, but before he could examine the invention, Meyer seized a big hammer and knocked its delicate machinery into chaos. "But I want that," protested the boss. "I know you do," answered the workman, quietly. "Come and see me to-morrow noon," continued the head of the firm, pompously, "and we will make some arrangements." "If you want to talk business with me," remarked the workman, coolly, "you can come to my lodging at seven o'clock to-night. Better not be late." The millionaire was there at seven. Meyer was taken into the firm, and in a short time he was at the head of the business. He lives in New Brunswick, N. J., in a pretentious house, and his sons are all well married. A short time ago the old man — he is more than seventy years of age—took it into his mind to marry again, picked out a beautiful nineteen-year-old girl, and prepared for the wedding. Immense opposition was expected from the family as old Meyer is worth $10,000,000 or $12,000,000 but to the amazement and chagrin of society and the sensational press, all of the old manufacturer's friends, family and connections backed him up heartily and sent him off on his bridal tour looking and feeling like a major. — *Invention.*

HOW THE HOTEL BRIGHTON IS TO BE MOVED.—The ownership of real estate on the south shore of Coney Island is so precarious, on account of the freaks of the untamed ocean, as to partake of the character of a lottery. A year or two ago, for example, the generous waves, during the winter, built up about a solid acre of sand at a point on West Brighton Beach, precisely where the new land could be used to most advantage by the owners of contiguous property. But, as a set-off to this unexpected and gracious favor, the hungry sea has gradually eaten

[1] At the time the Rookery building was visited by the writer, none of the partitions were in place, and the considerations of the plan were drawn entirely from the architects' drawings. We believe that on account of some delay the building is not yet entirely completed.

away the foundations of the Hotel Brighton, and that immense structure was doomed to swift destruction. Its owners, however, while there is yet time to save it, have determined to do so. It will be cut up into three longitudinal sections, a triple-track elevated railroad will be built beneath each part, one hundred flat cars will be run under, and a dozen or more engines, coupled tandem-wise, will draw the hotel to the desired place of security from the encroachments of the ocean. This truly is a novel undertaking. The enterprise which it illustrates will, perhaps, be best understood by the mere statement that the hotel weighs 5,000 tons, that it is three stories in height, surmounted by five towers, with a frontage of 460 feet and an average width of 150 feet. The bathing-pavilion, which is 475 feet long and 75 feet wide, is to be moved in a similar manner. The moral of it is that if the Yankee mind is ever shortsighted enough to build its house upon the sand, it is also ingenious enough to devise means to rectify its mistake. — *Newark Advertiser.*

Concrete Forts. — It is known, remarks the *Revue Scientifique*, that the new fortifications at Antwerp have been built on new plans, adopted for the purpose of meeting the progress of modern artillery, and especially to provide against the use of the improved projectiles. The explosion of shells of the latest patterns is very destructive to masonry walls, as was shown at Cummersdorf and the fort of Malmaison. Accordingly, engineers have been led to substitute *béton* or concrete for brick or stone masonry in those parts of a fortification which are exposed to the fire of siege-guns. At the fort of Schooten, which is part of the advanced line of defense at Antwerp, all the casemates are of beton. These casemates are three metres in thickness at the crown of the arch, and it is believed that they will be strong enough to withstand the effect of any fire. It may be noted that the extreme precision and the long range of modern siege-guns have made it necessary to abandon almost entirely the defense of forts by guns *en barbette* or in the open air. For this reason all the heavy guns are now covered or placed in casemate, and for defense against assault smaller rapid-firing guns and machine-guns or mitrailleuses are provided.

The Old New Haven State-House. — The State-House was built sixty years ago from plans of Architect Ithiel Towne, of chip-stone from East Haven quarries, covered with stucco, and was a cheap imitation of the Acropolis of Athens, its cost being about $30,000. The site was the old cemetery of New Haven colony, and its foundations rest upon the graves of many of the earliest settlers. There was strenuous opposition to its erection on the Green, and the trenches were partly dug and the foundations laid at night for fear of violence by the opposing party. Builders assert that the trenches were not dug to the bottom of the graves, owing to the haste thought necessary, and that the foundations are constantly sinking in consequence. The building is in a ruinous condition, as no repairs have been made to it since 1874, when a session of the Legislature was held in New Haven for the last time. Previous to that year New Haven and Hartford were both capitals of the State, and the General Assembly met one year in one city and the next year in the other. Hartford people succeeded in securing an amendment to the Constitution, making Hartford the sole capital, and New Haven was left with the old State-House on her hands with no use to put it to. — *New York Times.*

Christian Antiquities in Rome. — A correspondent writes from Rome to the *Frankfurter Zeitung*: "Some time since, owing to the exertions of the Passionist monk, Father Germanus, two chambers of a Roman house of the fourth century were discovered under the high altar of the church of SS. John and Paul, on the Cœlian Hill. Quite lately another large chamber has been discovered beneath the nave of the church, which seems to have been the *tabularium* of the house. The traces, very well preserved, are visible of what must have been valuable paintings representing wild beasts, sea-horses, and other decorations. Especially remarkable are two pictures of unquestionable Christian character. One represents the Patriarch Moses in the act of removing his shoes before approaching the burning bush — a subject which is also represented in one of the pictures in the catacomb of Calixtus. The other represents a woman praying; she is clad in a tunic, with a veil on her head, a necklace of pearl, and arms outstretched. This is believed to be the first specimen of a Roman house in which scenes of a Christian character have been found represented. Such subjects have hitherto been found only in the catacombs."

Proposed new National Buildings. — An unusually large number of bills for the erection of public buildings were introduced in the senate Dec. 12, the aggregate sum asked for being $7,645,000. Senator Blair desires to have $100,000 buildings erected at both Dover and Nashua, N. H.; Mr Frye a $40,000 structure at Houlton, Me., and Mr. Aldrich, buildings at Pawtucket and Woonsocket, R. I., the cost of which is not stated. The largest sums asked for are: Omaha, $1,500,000; Milwaukee, $1,200,000; and New Orleans and Kansas City $1,000,000 apiece.

Was It Fireproof? — Wife (reading the paper) — I see that considerable discussion has arisen among experts as to whether the Metropolitan Storage Warehouse was or was not fireproof.

Husband — Yes.

Wife — Was the building totally destroyed?

Husband — Yes, burned to the ground.

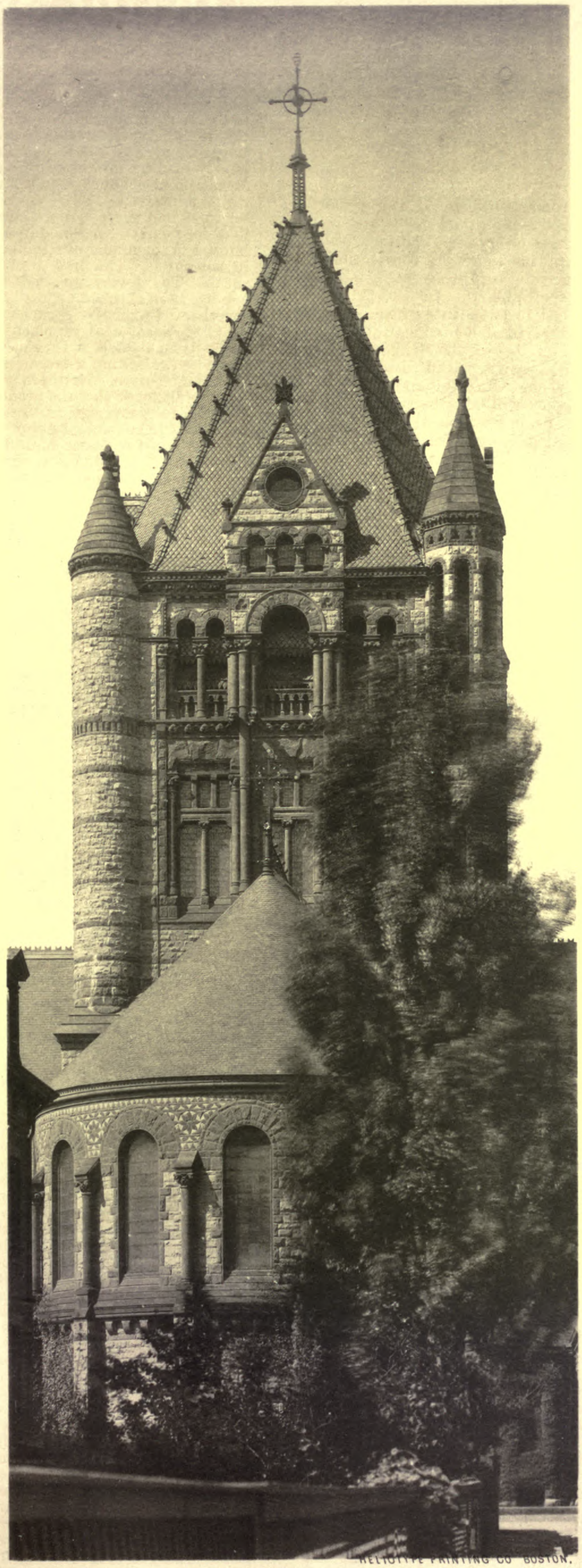
Wife (thoughtfully) — Well, now that it is a mass of ruins, I suppose the matter will be very difficult to determine. — *New York Sun.*

The Submerged City, Regamuende. — A city at the bottom of the sea was seen toward the end of October near Treptow in Prussia, when a powerful south wind blew the waters of the Baltic away from the shore, uncovering a portion of ground usually hidden from sight by the waves. It was the ruins of the city of Regamuende, once a flourishing commercial station, which was swallowed by the sea some five centuries ago. The unusual spectacle was enjoyed but for a few hours, when the storm slackened and the waves returned. — *Baltimore American.*

TRADE SURVEYS

Business of all kinds throughout the country has kept up all through the year at maximum limits. Prices have been neither high nor low. Competition has rendered excellent service to both producers and consumers. Conservatism has been maintained in all branches of trade which is likely to continue throughout the winter and spring. The danger of over-production is being very carefully guarded against by individual prudence, and by the influences of trade combinations of every character. Banking and money-loaning interests are also contributing their *quota* to maintain conservatism of conduct upon the part of our manufacturers and managers of railroad interests. There is an abundance of money for all legitimate enterprises, but there is more care exercised by money-loaning interests now than for years. An abundance of money is seen in all branches of trade, but not to the extent of stimulating speculation and of leading to a rashness in enterprise. The iron trade closes the year with flying colors, so to speak. The downward tendency in prices which was noticed some time ago has been checked. Cost of production and prices realized are very near together. Productive capacity has been steadily increased all through the year. A great deal of blast-furnace capacity is now under construction, and will be erected, it is said, within from three to five months. Southern furnaces are selling a larger percentage of their output in home markets than ever before. Northern furnaces are being put in a better condition little by little, so that the producing capacity of the North as compared to two or three years ago has been considerably improved. Our dependence upon foreign sources of supply still continues. Within the past few days large orders for plates and structural iron have been placed in foreign markets. This is likely to result in a change of quotations at home. The steel-rail makers and buyers are still at outs. Last week orders were about 40,000 tons. Quotations are $31.50 to $33. Buyers are holding off for a reduction to $30 or $31. Makers will shut down several of their mills next week, unless orders show up in the meantime. The probabilities are that the syndicate will be able to force buyers into the market, although buyers so far refuse to yield a point, and declare they will postpone purchases for several weeks. If this course should be pursued, it increases the possibility of a sudden demand in midwinter, which will force prices up to the point which rail-makers say they ought to reach. The foreign iron and steel markets are in a better condition than they have been for perhaps twelve months. Colonial, continental and home ship-building, marine engine-building and general consumptive requirements are considerably increased, and a better feeling prevails in iron, steel and coal-trade circles. The benefit, however, has not reached the working classes, and will not, as the supply of labor is in excess of any probable demand upon it Advices from several interior points within the past ten days show that there is a surprisingly large distribution of products of all kinds. In the returns published from thirty-eight cities a decrease is shown in the volume of business last week as compared to the same week last year of 17 per cent. The reports from over one hundred railroad companies show the usual improvement and a healthy condition of traffic. No combination of railway interests seems possible or probable that will work injustice to the general public, particularly in the Northwest. An immense amount of railway construction has been pushed through in that region this year. The Manitoba has built 932 miles, another large system 428 miles, and there are now 500 miles of road-bed ready for iron. The total mileage of the Northwest so far this year is 4,534 miles. The mileage in the Southern States this year is about 1,400 miles. The returns from the Southwest are not yet in, but that region will be able to show an increase. The builders throughout the West and Southwest are not discouraged over the possibility of less railroad building next year, but believe that in any event the building requirements for 1888 will be fully up to those of this year. This is a wiser view to take. A great deal of house-building must necessarily follow, because of the natural requirements following in the wake of railroad and manufacturing expansion. Preparations are being made for material, and Chicago dealers speak of large purchases already for next spring's delivery. The prairie region will be calling for more lumber next year than this, and it is not probable that the Eastern markets will call for any less. Logging operations will be conducted upon a more extended scale. Prices will likely open in the spring where they closed in the fall. Western lumber using shops have bought large quantities of hard-wood. House-builders are noting an improving lumber demand for interior finish, and a great many are making themselves safe against the possibility of an advance. Wise lumber dealers are not anxious to crowd prices up on account of improving inquiry, but are encouraging it by liberal and attractive figures. There is a steady distribution of finished lumber from the South, and prospects are that shipments from the South during the coming year will be increased at least 25 per cent. Yellow-pine for railroad-building, car purposes and building purposes is increasing, and this competition is an additional factor which white-pine dealers will not fail to take note of. In all branches of trade and industry there is a healthy feeling. No one anticipates a stringency of money. Very few anticipate unfavorable financial or economic legislation n Congress. Political considerations the public believe will induce the law-makers to do no more than dance a few war dances, and throw the question at once to the people in the next Presidential campaign. Manufacturing interests of the New England and Middle States will make a more or less conservative movement to strengthen the tariff movement throughout the West and South. They do not feel so certain of making a strong impression next year as they have in former years. The necessity of some sort of a revision is recognized by them and all others, but they will endeavor to create a strong undertone of tariff sentiment which will prevent any dangerous or radical measures being carried through. Architects in all parts of the country anticipate a busy season in 1888. The Builders' Convention to be held at Cincinnati in February will, in all probability, draw a very large number of builders together, when measures will be formulated, if it is possible to do so, by which divergent methods and views will be harmonized, and a greater degree of harmony established. The workmen throughout the country, according to present advices, will not make any radical or unjust demand. Hours of labor will not probably be interfered with. Higher compensations may be asked for in isolated localities, but there will be no general demand. American labor feels that employers are liberal and just, and any attempt to make a general strike would probably create a reaction within trade organizations. The spread of building and loan associations is quietly laying a sub-stratum of conservatism which will not be without its influence upon the leaders and agitators in public organizations.

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